

NEW SERIES

**SELECTED
WATER
RESOURCES
ABSTRACTS**



**VOLUME 2, NUMBER 5
MARCH 1, 1969**

NEW

SERIES

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is \$22.00 (domestic), \$27.50 (foreign); single copy price is \$3.00.



SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior



VOLUME 2, NUMBER 5
MARCH 1, 1969

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions AND Suspensions

TURBIDITY MAXIMUM OF THE NORTHERN CHESAPEAKE BAY,

Johns Hopkins Univ., Baltimore, Maryland, Chesapeake Bay Inst.

For primary bibliographic entry see Field 02L.

For abstract, see .

W69-01600

02. WATER CYCLE

2A. General

LAKE SUPERIOR MODEL INDEPENDENT STUDY REPORT,

Wisconsin Univ., Madison, Water Resources Center.

For primary bibliographic entry see Field 06A.

For abstract, see .

W69-01596

A COMPENDIUM OF MAJOR INTERNATIONAL RIVERS IN THE ECAFE REGION.

United Nations, Economic Comm for Asia and the East, Bangkok, Thailand. Div of Water Resources Dev.

Water Resources Series No 29, 75 p, 1966. 11 fig, 1 append, 28 ref.

Descriptors: *International waters, *Data collection, *Rivers, *Hydrologic data, River basin development, Flood control, Hydroelectric power, Water supply, Irrigation, Navigation.

Identifiers: *Asia, *International rivers, Mekong, Red, Brahmaputra, Meghna, Ganges, Kosi, Gandak, Gogra, Sutlej, Indus, Kabul, Helmand.

Basic data are compiled for the major rivers of the area of the Economic Commission for Asia and the Far East (United Nations). The 12 river systems covered in the compilation are the Mekong, Red, Brahmaputra, Meghna, Ganges, Kosi, Gandak, Gogra, Sutlej, Indus, Kabul, and Helmand. The information compiled includes basic data on physical features, hydrology, meteorology, completed projects, and planned development projects. All the rivers have great potential for development of water supplies, irrigation, power, and navigation. They all have severe flood damage potential that must be controlled for full development of their basins. Whenever severe floods occur in the Brahmaputra and the Ganges, for example, hundreds and even thousands of lives are lost, millions are made homeless, and crops and property damages are so great as to affect the economies of the countries as a whole. ECAFE as an international organization can offer services to help bring about cooperation among riparian countries for development projects such as the Mekong and Indus projects. (Lang-USGS)

W69-01599

NOAH, JOSEPH, AND OPERATIONAL HYDROLOGY,

IBM Watson Research Center, Yorktown Heights, New York.

Benoit B. Mandelbrot, and James R. Wallis.

Water Resources Res, Vol 4, No 5, pp 909-918, Oct 1968. 10 p, 21 ref.

Descriptors: *Statistical models, *Hydrology, *Mathematical studies, Statistics, Synthesis, Time series analysis, Fourier analysis, Markov processes.

Identifiers: Self-similar statistical models.

The use of 'self-similar' models in statistical hydrology appear very promising in treating the 'Noah effect,' the observation that extreme

precipitation tends to be very extreme, and the 'Joseph effect,' the observation that long periods of unusual high or low precipitation tend to be very long. Current models of statistical hydrology cannot account for either effect. Self-similarity, a statistical means of accounting for after-effects, is used to attempt to account for the empirical observations of Harold E Hurst on long term hydrological trends. The applicability of self-similar statistical models to long term hydrological records is discussed and summarized. (Knapp-USGS)

W69-01608

exponential. Data taken on two small watersheds (140 links) show reasonable agreement with this hypothesis.

W69-01613

HORTON'S LAWS OF STREAM LENGTHS AND DRAINAGE AREAS,

U. S. Geological Survey, Washington, D. C.

Adrian E. Scheidegger.

Water Resources Res, Vol 4, No 5, pp 1015-1021, Oct 1968. 7 p, 1 fig, 5 tab, 11 ref.

Descriptors: *Geomorphology, *Hydrogeology, *Drainage patterns (Geologic), *Streams, *Terrain analysis, Channels, Drainage density, Statistical methods, Mathematical models, Synthetic hydrology.

Identifiers: Drainage basin characteristics, Horton analysis, Stream lengths, Stream numbers, Stream orders, Drainage areas.

Horton's metric laws of stream lengths and drainage areas are examined and the validity of the concept of cycles or generations of rivers is questioned. The usual explanation of such cycles depends upon some topological features in river basins that do not seem to occur in nature. The most serious objection is that many actual stream networks are not structurally Hortonian or self-similar; that is, subnets of one generation are not necessarily topologically similar to those of other generations. It seems more likely that stream networks more closely resemble mathematical bifurcating arborescences in which the probability of branching is the same in any segment. Such networks rationally explain Horton's laws of stream lengths and drainage areas without any specific structural assumptions regarding river nets and without recourse to theories of cyclic basin development. (Knapp-USGS)

W69-01618

MINIMUM FLOW OF SMALL RIVERS IN THE ASIATIC USSR,

A. M. Vladimirov.

Translated from Trudy Gos Gidrol Inst No 139, 1967. pp 4-23. Soviet Hydrol, Selec Pap No 1, pp 1-16, 1967. 16 p, 5 fig, 3 tab, 50 ref.

Descriptors: *Base flow, *Surface-groundwater relationships, *Estimating, *Statistical methods, *Runoff forecasting, Discharge (Water), Geomorphology, Hydrogeology, Permafrost.

Identifiers: Asiatic USSR, Curve fitting, Hydrological estimation, Small rivers.

Because gaging stations are few and widely scattered in Asiatic USSR, methods for computing baseflow of small rivers by using regional hydrological parameters were developed. Graphs of the relationship between low flow and drainage basin area were plotted for 69 regions with different geomorphological and hydrogeological structures, using a 1:5,000,000 hydrogeological map. The relationship of minimum 30-day runoff (M) to basin area (F) is of the form $M = F^n$ to the power n throughout most of Asiatic USSR. Base flow (Q_{min}) was related to the other parameters by the relation $Q_{min} = a(F \text{ to the power } n)$. The relation was calculated for rivers in both the warm and cold seasons. Intermittent streams were described by the relation $Q_{min} = b((F - C) \text{ to the power } n)$ where $C =$ the average area of the basin which contributes no flow. Values of the parameters for the 69 regions are tabulated. Streams in permafrost areas differ somewhat because water is stored in ice in cold weather and released in summer. The deviation of actual flow from predicted flow is 10-25% in regions with plentiful gaging data, and as high as 30% in areas with scanty data. (Knapp-USGS)

W69-01626

SMALL WATERSHED STORAGE USING LOW DAMS,

Massachusetts Univ, Amherst, Dep of Civil Engineering.

Karl N. Hendrickson.

Field 02—WATER CYCLE

Group 2A—General

Mass Univ, Water Resources Res Center, Symp Proc, Publication No 3, pp 141-152, June 2, 1967. 13 p, 1 map, 2 graph, 9 ref.

Descriptors: *Small watersheds, *Dam, Water management (Applied), *Design, *Project planning, Reservoir operation, Watershed management, Flood control, Water supply, Infiltration, Base flow.

Identifiers: Low dam system.

The literature of design criteria and cost-benefit analysis for construction of dams on small watersheds is reviewed and condensed for the use of local water administrators. The principles of hydrology are briefly reviewed. A detailed procedure for management and design is given. An example of a small watershed impoundment owned by the Amherst Water Board is analyzed, and the data used and the design and management decisions made are summarized. (Knapp-USGS)
W69-01636

ATMOSPHERIC CONTRIBUTIONS TO WATER QUALITY OF STREAMS IN THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE,

U. S. Geological Survey and Sears, Roebuck and Co., Chicago, Illinois, and Dartmouth College, Hanover, New Hampshire.
D. W. Fisher, A. W. Gambell, and G. E. Likens. Water Resources Res, Vol 4, No 5, pp 1115-1126, Oct 1968. 12 p, 4 fig, 5 tab, 15 ref.

Descriptors: *Dissolved solids, *Runoff, *Precipitation (Atmospheric), Aluminum, Sulfates, Nitrates, Silica, Hydrogen ion concentration, New Hampshire.

Identifiers: Hubbard Brook Experimental Forest (New Hampshire).

The relationships between precipitation, stream discharge, and concentrations of mineral constituents of 3 tributaries of Hubbard Brook, New Hampshire, were studied. Hydrologic data and chemical analyses of precipitation and stream water were collected over a 2 yr period. It was found that precipitation supplies most of the 30-50 kg per hectare of sulfate. Input of ammonium and nitrate to the streams exceed discharge of these ions from the basin. Maximum nitrate concentrations are 2 mg/l and occur in early spring. Hydrogen ion is one of the major cations in precipitation. Bicarbonate and silica vary directly with each other and inversely with alumina. Silica discharge ranged from 20-40 kg/hectare. (Knapp-USGS)
W69-01644

PROGRESS REPORT (STUDY OF RATIONAL METHOD),

John C. Schaeke, Jr.

Progress Report of the Storm Drainage Research Project, Johns Hopkins University - Report No XI.

Descriptors: *Rainfall intensity, *Storm runoff, Storm drainage.
Identifiers: *Urban drainage, *Calculations.

The observations of 19 gaged urban drainage areas was used to verify or study the Rational Method. The concentration time used was the center of mass of the rainfall hyetograph and the runoff hydrograph. The C-factor was determined by plotting frequency distributions of observed rainfall intensities and peak runoff rates on logarithmic probability paper. Equations for concentration time and 'C' factor are given provided the drainage area has certain characteristics.
W69-01894

THREE-DIMENSIONAL TYPE REPRESENTATION OF HYDROLOGICAL DATA,

For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01912

ANALYSES AND APPLICATION OF SIMPLE HYDROGRAPHS,

For primary bibliographic entry see Field 07B.
For abstract, see .
W69-01913

DISSIPATIVE RIVER FLOW MODEL,

D. R. Jackson.
J Hydrology, Vol 6, No 1, pp 33-44, Jan 1968.

Descriptors: *Model studies, Rivers, Runoff.

Derivation and solution of second order differential equation of river system is presented; model assumes routing rainfall excess through series of resistive and dissipative elements; some suggestions for fitting model to actual data are presented; comparison is made with other models.
W69-01917

RAINFALL AS AFFECTING FLOW IN SEWERAGE SYSTEMS,

C. C. Judson.

Surv, Vol 84, Nos 2168, 2169, 2170, pp 119-20, 141-3, 163-5, Aug 11, 18, and 25, 1933.

Descriptors: *Rainfall intensity, *Runoff, *Sewers, Flow measurement, Storms.

Discussion of principal rainfall factors; area of watershed, intensity of rainfall; time of concentration; area-time diagrams; methods of calculating run-off; author's method; possible economics.
W69-01919

MEASURING RAINFALL AND RUN-OFF AT STORM-WATER INLETS,

For primary bibliographic entry see Field 07B.
For abstract, see .
W69-01923

LINEAR ANALYSIS OF RAINFALL-RUNOFF RELATIONSHIP,

For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01924

A BASIC STUDY OF THE RAINFALL EXCESS-SURFACE RUN-OFF RELATIONSHIP IN A BASIN SYSTEM,

For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01925

2B. Precipitation

A LEAST-SQUARES HYDROGRAPH ANALYSIS OF COMPLEX STORMS ON SMALL AGRICULTURAL WATERSHEDS,

Agr. Research Service, Hydrograph Lab., Beltsville, Maryland.

D. E. Overton.
Water Resources Res, Vol 4, No 5, pp 955-963, Oct 1968. 9 p, 8 fig, 2 tab, 13 ref.

Descriptors: *Unit hydrographs, *Hydrograph analysis, *Synthesis, *Storm runoff, Rainfall, Streamflow forecasting, Regression analysis, Demonstration watersheds, Maryland.

Identifiers: *Least-squares hydrograph, Storm hydrograph.

The feasibility of using a least-squares technique to extract unit hydrographs from data of complex storms on small agricultural watersheds was investigated. The procedure is the reverse of hydrograph synthesis. Rather than summing unit hydrographs to synthesize a complex storm, the unit hydrograph was calculated. The feasibility of the technique was clearly shown on four of the five Agricultural Research Service watersheds in the study. Large perturbations occurred in the calculated unit hydrographs on one of the watersheds, but reasonable results were obtained on the

remaining four. The calculated unit hydrographs varied from storm to as expected. The results of these analyses demonstrate the feasibility of the least-squares technique as a means of analyzing all storm hydrographs on small agricultural watersheds to detect the nonlinearity of the rainfall-runoff process. (Knapp-USGS)
W69-01622

RESULTS OF RADAR MEASUREMENTS OF LIQUID PRECIPITATION,

For primary bibliographic entry see Field 07B.
For abstract, see .
W69-01666

REPORT OF U. S. WEATHER BUREAU STUDIES IN RADAR HYDROLOGY,

For primary bibliographic entry see Field 07B.
For abstract, see .
W69-01671

ADJUSTMENT OF RADAR ESTIMATES OF STORM MEAN RAINFALL WITH RAIN GAGE DATA,

F. A. Huff.
J Applied Meteorology, Vol 6, No 1, pp 52-6, 1967.

Descriptors: *Rain gages, *Rainfall intensity, Storms.
Identifiers: *Radar measurement.

Evaluation of feasibility of using surface rain gage data to modify radar-rainfall equation for specific storm conditions; data used were for 19 storms, and study was restricted to warm-season, unstable precipitation and to use of 10-cm radar; normal climatic network was found inadequate for modification, for area and conditions studied, if relatively accurate estimate is needed; however, correspondence of radar and rain gage patterns was much better with 10-cm radar than it had been with 3-cm radar.
W69-01673

A TIME INTERVAL DISTRIBUTION FOR EXCESSIVE RAINFALL,

H. C. S. Thom.
ASCE Proc, J of Hydr Div, Vol 85, No HY7, p 83, 1959.

Descriptors: Rainfall intensity, *Sewers, *Design.

The methods usually used for frequency analysis of excessive precipitation average the recurrence intervals and thus obscure much useful information for the design of sewerage systems. Additional information can be obtained however by relating probability to recurrence interval instead of rainfall depth, thus giving the distribution of recurrence interval for a predetermined amount of rainfall.
W69-01898

CITY OF OAKLAND DEVELOPS NEW RAINFALL INTENSITY-DURATION CURVES,

D. M. Winton.

Pub Works, Vol 90, No 7, p 120, 1960.

Descriptors: *Rainfall intensity, Design.
Identifiers: *Storm sewers, *Calculations, Oakland (Calif.).

Based on a report compiled by Fites, L. A., the author gives a brief account, with tables and graphs, of the 1958 rainfall intensity-duration curves now being used in the city of Oakland, Calif., for the design of storm sewers.
W69-01908

RAINSTORMS MADE TO ORDER,

For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01914

Evaporation and Transpiration—Group 2D

SPATIAL DISTRIBUTION OF HEAVY STORM RAINFALLS IN ILLINOIS.

F. A. Huff.

Water Resources Res, Vol 4, No 1, pp 47-54, Feb 1968.

Descriptors: *Storms, Rainfall intensity.

Identifiers: *Calculations, Illinois.

An 11-year continuous record from 49 recording rain gages on 400 square miles in central Illinois has been used to derive characteristic area-depth relations in heavy rainstorms for storm periods of 30 minutes to 48 hours on areas of 50, 100, 200, and 400 square miles. First, eight general equations were statistically tested to determine the most appropriate fitting method for the area-depth curve. Over-all, an equation relating rainfall depth to the square root of the area received the highest score. However, the equation that fit best was found to vary with areal size, mean rainfall, and storm duration, which, in turn, reflected general trends in relative variability and skewness of the rainfall spatial distribution. Because of the high degree of variability in the area-depth relation between storms, the analytical results have been presented as probability distributions for given sets of conditions with respect to area, storm duration, and rainfall volume. Thus, the user is provided with both average curves and curves applicable to more extreme patterns of storm rainfall.

W69-01915

TIME DISTRIBUTION OF RAINFALL IN HEAVY STORMS.

F. A. Huff.

Water Resources Res, Vol 3, No 4, p 1007, 1967.

Descriptors: *Storms, Rainfall intensity.

Identifiers: *Calculations, Illinois.

Time distribution relations have been developed for heavy storms on areas ranging up to 400 square miles and presented in probability terms to provide quantitative information on interstorm variability and to provide average and extreme relations for various applications of the findings. It was found that the relations could be represented best by relating per cent of storm rainfall to per cent of total storm time and grouping the data according to the quartile in which rainfall was heaviest. The individual effects of mean rainfall, storm duration, and other storm factors were small and erratic in behavior when the foregoing analytical technique was used. Basin area had a small but consistent effect upon the time distribution. The derived relations are applicable to the Midwest and other areas of similar climate and topography. They can be used in conjunction with published information on spatial distributions and other storm parameters to construct storm models for hydrologic applications.

W69-01916

2C. Snow, Ice, AND Frost**SNOWMELT AT AN INDEX PLOT,**

New Brunswick Univ., Fredericton, N. B., Canada. D. W. Pysklywec, K. S. Davar, and D. I. Bray. Water Resources Res, Vol 4, No 5, pp 937-946, Oct. 1968. 8 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Snowmelt, *Runoff forecasting, *Heat budget, *Regression analysis, Water yield, Meteorological data.

Identifiers: Canada, New Brunswick, Snowmelt index plot.

A large experimental index plot was installed in an open area near a climatological station in the North Nashwaik Stream Basin, N B, to obtain data for relation between snowmelt measured at the plot and regional meteorological parameters related to the snowmelt process. The data collected during the 1966 spring snowmelt season were analyzed by the degree-day method, the U S Corps of Engineers

generalized snowmelt equations, and optimal regression equations derived from the measured snowmelt at the index plot and related thermal budget indices calculated using individual meteorological parameters. The methods gave generally comparable results; their specific merits and limitations are discussed. The deviation of seasonal totals by the three methods varied from -15.6 to +54.5%. The relative accuracy of the three techniques as daily predictors compared by taking the root-mean-squared values of the deviations of daily estimated snowmelt from the daily measured values ranged from 0.17 to 0.22 in. It is suggested that experimental index snowmelt plots and optimal regression equations may enable dependable prediction of point snowmelt rates to use for estimation of basin-wide snowmelt and hydrograph synthesis. (Knapp-USGS) W69-01597

ALBEDO OF INTERCEPTED SNOW,

Northeastern Forest Experiment Station and Syracuse Univ., College of Forestry, Syracuse, New York.

For primary bibliographic entry see Field 02I.

For abstract, see .

W69-01598

PRINCIPAL HEIGHT ZONES OF STREAMFLOW FORMATION IN CENTRAL ASIA IN DIFFERENT MONTHS OF THE GROWING SEASON,

T. S. Abal'yan.

Soviet Hydrol, Selec Pap No 1, pp 72-81, 1967. 10 p, 2 fig, 3 tab, 17 ref.

Descriptors: *Streamflow forecasting, *Snow surveys, *Snowmelt, Runoff forecasting, Water supply, Synoptic analysis, Hydrologic properties, Meteorological data.

Identifiers: USSR, Central Asia, Streamflow formation.

The altitude zones providing meltwater runoff for each month in the growing season of central Asia, USSR, were determined by multiple correlation analysis of runoff and snow survey data. Streamflow forecasting in Central Asia, which has extremely uneven climatic, hydrologic, and other physiographic characteristics, is possible with the assumption that climatic variation in the mountains has a well defined pattern related to altitude. Regression analysis is used to determine whether the character of variation of snowpack with altitude, heat flux distribution and precipitation vary between drainage basins in a region. Monthly discharge data for 43 rivers in Central Asia were collected and tabulated, monthly discharges were correlated with the areas of altitude zones where snowmelt occurs each month and the results were tabulated. Runoff and elevations were plotted and interpretation of the graph provides the amount of runoff for each altitude zone. The analysis facilitates streamflow forecasting by snow surveying. (Knapp-USGS) W69-01601

METHOD OF FORECASTING ICE PHENOMENA IN RIVERS,

Hydrometeorological Scientific Research Center, USSR.

N. A. Bagrov, and A. P. Kukhto.

Trans. from Meteorol i Gidrol, No 2, 1967, pp 22-28. Soviet Hydrol, Selec Pap No 1, pp 97-102, 1967. 6 p, 1 fig, 2 tab, 5 ref.

Descriptors: *Freezing, *Rivers, *Forecasting, *Synoptic analysis, Climatology, Charts, Meteorology, Regions, Regression analysis.

Identifiers: *Ice phenomena, USSR.

Methods for predicting freezing of rivers in the USSR using atmospheric circulation and thermal budget data over very broad regions are discussed. Because initial autumn heat contents of rivers are much less variable than cooling-season weather,

dates of ice formation are determined chiefly by the cooling history of the water. Multiple regression analysis is used to determine the effectiveness of predictors chosen by techniques of synoptic analysis in predicting data of freezing. (Knapp-USGS) W69-01602

DISTRIBUTION OF THE WEIGHT OF SNOW COVER IN THE USSR,

V. I. Kipovskaya.

Translation from Gl Geofiz Observ No 210, 1967, pp 68-78. Soviet Hydrol, Selec Pap No 1, pp 63-72, 1967. 10 p, 5 fig, 5 tab, 7 ref.

Descriptors: *Snow cover, *Snow surveys, *Water equivalent, Synoptic analysis, Data collections, Frequency, Maps, Meteorological data.

Identifiers: USSR, Snow accumulation, Applied climatology.

Snow survey data for the USSR from 1936 to 1960 from 700 stations were analyzed for water equivalent and snow depth. Maps of the water equivalent of snow accumulations of 50, 20, 10, and 5% probability were compiled. The water equivalent of snow varies greatly in the USSR. The highest coefficients of variation are in the Ukraine (0.51), Belorusia (0.57), the Baltic States (0.60), Maritime Province (0.57), and Krasnodar Province (0.71), all areas of unstable snow cover; the lowest are in areas of stable accumulation. Water equivalents are higher in forested than in open areas. (Knapp-USGS) W69-01631

2D. Evaporation and Transpiration**PATTERNS OF THE THERMAL REGIME OF THE SURFACE LAYER OF WATER,**

M. P. Timofeyev, and S. P. Malevskiy-Malevich.

Translation from Meteorol i Gidrol, No 2, 1967, pp 57-65. Soviet Hydrol, Selec Pap No 1, pp 102-109, 1967. 8 p, 2 fig, 6 tab, 14 ref.

Descriptors: *Air-Water interfaces, *Heat budget, *Heat transfer, *Thermal stratification, *Bodies of water, Evaporation, Convection, Radiation, Winds, Waves (Water).

Identifiers: *Heat exchange, *Thermal regime, USSR, Lake Baikal, Lake Sevan.

The processes of heat exchange between water surface and overlying air are reviewed and examples calculated for Lake Baikal, the North Atlantic Ocean, Lake Sevan, and an evaporation pan. Results of measurements of the water temperature at various depth, wave height, wind velocity, air temperature, and radiation balance were compared with calculated values. The main forms of heat exchange between the water surface and the atmosphere are known to be the turbulent exchange of sensible heat, radiation, and heat exchange associated with phase changes of water (mainly evaporation). These forms of heat exchange depend strongly on the characteristics of the thin surface layer of water, mainly on its temperature and that of the adjacent air layer. But the temperature of the thin surface layer of water, which affects the different forms of heat exchange, is independent on the direct influence of solar radiation, since absorption of radiation in a thin layer is negligibly small. The results testify to the fact that under normal conditions, except during severe storms for which data are lacking, the temperature gradient in the upper layer of water remains negative. (Knapp-USGS) W69-01604

THE RESPONSE OF WATER TEMPERATURES TO METEOROLOGICAL CONDITIONS, Vanderbilt Univ., Nashville, Tenn; Office of the Surgeon, Headquarters, U. S. Army Vietnam; and Johns Hopkins Univ., Baltimore, Maryland.

Field 02—WATER CYCLE

Group 2D—Evaporation and Transpiration

John E. Edinger, David W. Duttweiler, and John C. Geyer.
Water Resources Res, Vol 4, No 5, pp 1137-1143, Oct 1968. 7 p, 2 tab, 10 ref.

Descriptors: *Heat budget, *Surface waters, Heat balance, Temperature, Evaporation, Convection, Radiation, Meteorology, Air-water interfaces.
Identifiers: Surface temperature, Equilibrium temperature.

The calculation of heat exchange across air-water interfaces, one of the most important processes involved in thermal regimes of water bodies, is reviewed and discussed. The net heat exchange is the sum of the energy interchange by radiation, evaporation, and conduction between the water and air. Observable meteorological variables are used to calculate the thermal exchange coefficient and equilibrium temperature, which are used together to calculate net heat exchange. Many mathematical formulas and descriptions are available for use in thermal balance calculation. Temperature distributions within water bodies may be calculated in some relatively simple cases. Heat exchange calculations are necessary in predicting evaporation from proposed storage facilities. (Knapp-USGS)
W69-01642

2E. Streamflow and Runoff

INTRA-ANNUAL DISTRIBUTION OF SUBTERANEAN FLOW INTO RIVERS,
T. M. Chernaya.
Soviet Hydrol, Selec Pap No 1, pp 25-41, 1967. 17 p, 4 tab, 4 ref, 1 append.

Descriptors: *Surface-groundwater relationships, *Bank storage, *Groundwater movement, Discharge (Water), Base flow, Streamflow, Statistical methods, Data collections, Hydrogeology, Permafrost.
Identifiers: USSR, Physiographic controls, Subterranean flow.

Groundwater flow into rivers of the USSR is analyzed and discussed, using data from a collection made in compiling a map of groundwater flow for the USSR. Groundwater discharge has significant annual low and high flow periods. Periods of high discharge from alluvium generally last one season, usually spring, in the plains and generally 3 seasons, spring through autumn, in permafrost regions. Low alluvial flow lasts one season in warm areas and may be zero in permafrost regions. Flows for 39 rivers are tabulated. Preliminary results of a statistical analysis of the relation of groundwater discharge to physiographic parameters are presented in tables. In addition to problems concerning methods of computing intra-annual distribution of subsurface flow, an examination is made of results of an analysis of distribution patterns under various physiographic conditions. (Knapp-USGS)
W69-01603

INVESTIGATION OF THE STABILITY OF SOME EXPLICIT DIFFERENCE SCHEMES IN THE INTEGRATION OF SAINT-VENANT EQUATIONS,
Hydrometeorological Scientific Research Center, USSR.

V. I. Koren.

Translation from Meteorology and Hydrology, Meteorol i Gidrol, No 1, 1967, pp 42-48. Soviet Hydrol, Selec Pap No 1, pp 91-97, 1967. 7 p, 4 ref.

Descriptors: *Hydraulics, *Unsteady flow, *Mathematical studies, Flow rates, Velocity, Equations, Analytical techniques, Numerical analysis.
Identifiers: *Saint-Venant equations, Stability criteria.

To determine the possibility of extending the stability criteria obtained to nonlinear equations, numerical experiments were performed for a broad range of variation of initial and boundary conditions. Computations of the unsteady motion of water in rivers are based on the integration of a system of Saint-Venant equations. Numerical methods are given and mathematical solutions are presented. (Lang-USGS)
W69-01605

METHOD OF DETERMINING THE EFFECTIVENESS OF HYDROLOGIC FORECASTS IN ESTABLISHING THE OPERATING CONDITIONS OF HYDROELECTRIC POWER PLANTS,

S. B. Yelakovskiy.
Soviet Hydrol, Selec Pap No 1, pp 81-90, 1967. 10 p, 4 fig, 7 ref.

Descriptors: *Statistical methods, *Routing, Hydroelectric plants, Stochastic processes, Systems analysis, Mathematical studies, Management.
Identifiers: *Hydrologic forecasts, USSR, Volga River.

Principals for establishing the operating conditions of hydroelectric power plants are described. The effectiveness of several methods of predicting inflow to reservoirs used for electric power generation in the USSR is examined. For short term predictions of a year or less, hydrographs, routing methods, and other deterministic methods are highly accurate. For long term prediction, only probabilistic methods are reasonably reliable. Graphs and mathematical equations are presented. The method used to evaluate forecast effectiveness is illustrated by sample calculations for the Lenin Hydroelectric Power Plant on the Volga. (Knapp-USGS)
W69-01606

FLOOD SURGE ON THE RUBICON RIVER, CALIFORNIA--HYDROLOGY, HYDRAULICS AND BOULDER TRANSPORT,

U.S Geological Survey, Washington, D. C.
Kevin M. Scott, and George C. Gravlee, Jr.
U.S Geol Surv Prof Pap 422-M, pp M1-M40, 1968, 40 p, 33 fig, 5 tab, 34 ref.

Descriptors: *Floods, *Dam failure, *Surges, *Geomorphology, Erosion, Sediment transport, Sedimentology, Deposition (Sediments), California, Historic flood.

Identifiers: *Torrential rainfall, *Hell Hole Dam, Rubicon River (California).

The sedimentologic and geomorphic effects of a single catastrophic flow, caused by the failure of the Hell Hole Dam on the Rubicon River, in the Sierra Nevada, California on Dec 23, 1964, are documented. Extensive erosion of outwash terraces indicates a flow probably greater than any post-Pleistocene discharge. A rainfall of 22 in. in the 5 days preceding the failure produced record peak discharges. The surge discharges were greater than the previous record along the entire 61 miles route downstream, including the Rubicon, Middle Fork American, and North Fork American Rivers. As far as 36 miles downstream, flows were still 3.3 times the 100 yr flood. Average flood wave velocity was 22 fps. The diorite rockfill in the dam acted as a tracer; particles of fill moved no farther than 2.1 miles, and rounding of particles took place within 1.5 milcs. Intense local erosion initiated many landslides and other lateral sources of sediment. It is concluded that catastrophic floods may strongly influence mountain stream morphology without much effect on total sediment transport. They may modify bed patterns, cause cycles of increased mass movement, cause mass flow of coarse detritus in the channel, and cause extensive lateral supply of extremely coarse sediment. Flood debris is later dispersed by lower flows acting with weathering in place. (Knapp-USGS)

W69-01610

BASE-FLOW RECESSIONS--A REVIEW,
New Hampshire Univ., Durham.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01611

SOME FACTORS AFFECTING BASEFLOW,

Illinois State Water Survey, Urbana.
Krishan P. Singh.
Water Resources Res, Vol 4, No 5, pp 985-999, Oct 1968. 15 p, 8 fig, 15 ref.

Descriptors: *Base flow, *Recession curves, *Hydrograph analysis, Groundwater movement, Surface-groundwater relationships, Mathematical studies, Statistical methods, Evapotranspiration, Aquifers, Recharge.
Identifiers: Boussinesq equations.

Recession curves of stream-aquifer systems are analyzed and discussed in connection with problems of streamflow regulation for pollution control, farming practice evaluation, locating suitable areas for induced infiltration, and estimating the increase in baseflow from infiltration. For a shallow aquifer and a fully penetrating stream, the ideal baseflow curve may not be plotted as a straight line on semilog paper, and its recession rate continuously decreases with time. For a deep aquifer and a shallow-entrenched stream, the ideal base-flow generally decays exponentially, and its recession rate decreases with increasing stream entrenchment. In the case of loss from evapotranspiration, the baseflow curves steepen progressively with time, and the stream may become influent. In the case of gain from confined aquifers, the baseflow curves become flatter. The recharge results in shifting of the baseflow curves upward in magnitude or laterally in time. The baseflow peak occurs at about $0.75T$ from the beginning of recharge to the aquifer, where T denotes the effective duration of recharge. The lag between the total flow peak and the baseflow peak depends on rainfall, soil, and basin factors. The variability of these factors precludes the notion of a constant lag. (Knapp-USGS)
W69-01612

STATISTICAL PROPERTIES OF STREAM LENGTHS,

IBM Watson Research Center, Yorktown Heights, New York.

For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01613

COMPREHENSIVE BASIN STUDY SABINE RIVER AND TRIBUTARIES, TEXAS AND LOUISIANA,

Corps of Engineers, Fort Worth District.

Main Rep, Vol 1, Comp Basin Study, 183 p, Dec 1967. 4 fig, 10 plate, 28 tab, 5 append.

Descriptors: *Data collections, *River Basin Development, Flood control, Land management, Water supply, Watershed management, Transportation, Navigation, Recreation facilities, Texas, Louisiana, Water utilization.
Identifiers: *Sabine River Basin (Texas-Louisiana), Comprehensive planning.

A comprehensive study of the water resources, including recreational potential, hydroelectric power potential, and need for flood control of the Sabine River Basin, Texas and Louisiana, was made by the U.S Army Corps of Engineers, U.S Departments of Agriculture, Commerce, Health Education and Welfare, Interior, Federal Power Commission, and the States of Louisiana and Texas. The Sabine basin has major floods of long duration and frequent smaller floods. There are no major flood control improvements. Because channel capacities are inadequate, flood release channels are recommended. Water demands were projected to 2075. Both quantity and quality of water need to be adequate to meet projected demand. Recommen-

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dations for improvements include 3 major reservoirs at Mincola, Lake Fork, and Big Sandy, Greenville flood protection works, a navigation project from Echo to Pruitt Bluff, and 11 upstream watershed improvement projects. Estimated total construction cost is \$191,143,000 with \$1,684,600 annual cost. The benefit-cost ratio is 1.6 to 1. (Knapp-USGS)
W69-01617

HORTON'S LAWS OF STREAM LENGTHS AND DRAINAGE AREAS.

U. S. Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01618

WATERSHED SIMULATION BY STREAM PATH ANALOGY.

Agricultural Research Service Hydrograph Lab., Beltsville, Maryland.
C. A. Onstad, and D. L. Brakensiek.
Water Resources Res, Vol 4, No 5, pp 965-971, Oct 1968. 7 p, 3 fig, 2 tab, 12 ref.

Descriptors: *Hydrographs, *Routing, *Runoff forecasting, *Synthetic hydrology, Overland flow, Flow nets, Model studies, Simulation analysis, Watersheds (Basins).
Identifiers: Watershed models.

A model is proposed by which an outflow hydrograph is synthesized by routing input through a simulated drainage system. The simulated flow system is developed from a flow net. Overland flow is routed through paths defined by pairs of stream lines constructed normal to the contour lines (equipotentials) of the watershed, terminating at intersections with definite surface channels. Channel flood routing is then performed down to the basin outlet, with the calculated overland flow from each flow path as lateral input. Optimization of the system parameters is studied with respect of factors calculated from hydrograph moments. By comparison with visual judgments the hydrograph lag and shape factor were found to be possible criteria for optimization. (Knapp-USGS)
W69-01621

MAPS OF MINIMUM STREAMFLOW IN THE ASIATIC USSR.

V. A. Baranov, Z. I. Petersen, and L. N. Popov.
Translation from Trudy Gos Gidrol Inst No. 139, 1967, pp 24-35. Soviet Hydrol, Selec Pap No 1, pp 16-25, 1967. 10 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Data collections, *Low flow, *Base flow, *Hydrogeology, *Maps contours, Discharge (Water), Permafrost.
Identifiers: Asiatic USSR, Low-flow estimation.

A description is given of the distribution characteristics of minimum streamflow in Asiatic USSR. Minimum average monthly summer and winter runoffs are presented in 2 isoflow contour maps. Runoff characteristics for the Urals, West Siberian lowland, Kazakh folded country, Central Siberian highland, Altai and Sayan Mountains, Transbaikalia, Northeast Siberia, Far East Siberia, Sakhalin, and Kamchatka are described briefly. Flows and variability of flow are tabulated for 36 sub-regions. No account was taken of data on rivers regulated by lakes or reservoirs. The maps were compiled from field observations and from conversion factors. Data used in the compilation were collected at 3,955 hydrological stations between 1959 and 1966. (Lang-USGS)
W69-01628

THE GRAND RIVER AND ITS PLUME IN LAKE MICHIGAN,
Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-01651

LABORATORY STUDIES OF STORM OVERFLOWS WITH UNSTEADY FLOW.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01679

HYDRAULIC BEHAVIOR OF STORM WATER INLETS.

For primary bibliographic entry see Field 08B.
For abstract, see .
W69-01704

STORM-WATER OVERFLOWS FROM COMBINED SEWERS.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01726

DETERMINATION OF VARIABLE MAXIMAL INTENSITY COEFFICIENTS FOR STORM-SEWER CALCULATIONS.

L. T. Epshtien.
Vosdnn Sanit Tekh, No 5, p 15, 1960.

Descriptors: *Rainfall intensity, *Rainfall-runoff relationships, Design, Storm runoff.

Identifiers: *Storm sewers.

The author discusses a method for determining the coefficient of variable maximal intensities, or relative reduction in run-off intensities for individual collectors, for use in designing storm-water sewers.
W69-01780

HOW TO ESTIMATE STORM WATER QUANTITIES.

H. M. Giffit, and G. E. Symons.
Water and Wastes Eng, Vol 5, No 3, pp 46-50, March 1968.

Descriptors: *Storm runoff, *Rainfall intensity, Design, Drainage.

Identifiers: *Storm sewers, *Capacity, Calculations.

Several factors involved in determining quantities of storm water are discussed for storm sewer design as related to rainfall and runoff; derivation of formulas for calculation of drainage area shape, rainfall intensity-frequency data, time of concentration, and coefficient of runoff; nomograph for determining inlet time of flow.
W69-01785

A METHOD OF COMPUTING URBAN RUNOFF.

W. I. Hicks.
ASCE Proc, Vol 109, 1217, 1944.

Descriptors: Hydraulics, *Rainfall-runoff relationships, *Hydrographs, *Runoff forecasting.
Identifiers: *Urban drainage.

The author presents results of hydraulic investigations and rainfall - runoff gages and develops hydrographs for different sized areas, with varying degrees of development and time of concentration.
W69-01884

STORM RUN-OFF FROM URBAN AREAS.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01886

DETERMINATION OF RUN-OFF COEFFICIENTS.

F. W. MacDonald, and A. Mehn.
Pub Works, Vol 94, No 11, p 74, 1963.

Descriptors: Drainage system, *Land use, *Runoff.
Identifiers: Surface permeability, *Urban drainage, *New Orleans (La.).

Results of a study to determine times of concentration and obtain an accurate value for the coefficient of imperviousness of one of the large drainage districts of the city of New Orleans, La., carried out in cooperation with the Sewerage and Water Board, are summarized in Tables and discussed. Results indicate that the coefficient for built-up areas, which comprise over 4000 acres in the district is 0.548 whereas the coefficient for a typical suburban area is 0.455; the coefficient for the entire drainage district is 0.559. The Rational formula was employed to determine run-off coefficients using a 79-minute time of concentration, and the average value obtained was 0.653, this value being within the ranges recommended for combined residential and commercial areas.
W69-01889

FLOODING FREQUENCIES FOR URBAN DRAINAGE DESIGN.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01893

STUDIES OF SEVERE RAINSTORMS IN ILLINOIS.

G. E. Stout, and F. A. Huff.
ASCE Proc, J of Hydr Div, Vol 88, No HY4, p 129, July 1962.

Descriptors: *Rain gages, Watersheds, *Storms.
Identifiers: Urban drainage.

Study included a network of 10 recording rain gauges on a 10 sq mi urban area and investigated distribution characteristics of heavy rainstorms over urban watersheds for 10 year period. It was found (1) twice as many excessive quantities occur within a 10 mi² area compared with a specific point within area; (2) the percent of the 10 mi² area experiencing excessive rainfall increases with increasing storm duration; (3) majority of the excessive quantities of rainfall lasting from 30 to 24 hr occur in the same storms; (4) although a single rain gage records only a portion of the excessive rate occurrences in 10 mi², a point rainfall record is satisfactory index of frequency distribution of areal mean rainfall; (5) urban influences, if present, are not of practical significance in the distribution of excessive quantities.
W69-01896

PROBLEMS OF WATER DISCHARGE IN URBAN AREAS.

F. B. Veldkamp.
Commissie voor Hydrologisch Onderzoek T N O-Verslagen en Mededelingen, No 9-Verslag van de Technische Blijeenkomst, No 18, pp 73-94, 1963.

Descriptors: *Discharge (Water), *Rainfall-runoff relationships, *Storm runoff.
Identifiers: *Surface permeability, *Urban hydrology, Urban drainage.

Problems of water discharge in urban areas; discharge is calculated from rainfall and runoff from area of roofs, street and sidewalk surfacings, and backyards connected to sewer system; runoff is assumed to be 100%; storage basins are calculated from storms with frequency lower than once every year.
W69-01899

RUNOFF ESTIMATION FOR VERY SMALL DRAINAGE AREAS.

Warren Viessman.
Water Resources Res, Vol 4, No 1, pp 87-94, Feb 1068.

Descriptors: *Storm runoff, *Hydrographs, *Runoff forecasting, Rainfall-runoff relationships.
Identifiers: *Urban hydrology.

Analyses of hydrologic data from high-intensity short-duration storms on very small drainage areas

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having varying physical characteristics indicated that a 1-minute unit hydrograph could be used as the basis for generating runoff from an effective rainstorm input. The single parameter of the unit hydrograph (time constant K) was shown to be related to the physical characteristics of the drainage area. No evidence of the correlation between K and the storm pattern was discovered. Procedures are given for estimating net storm inputs.
W69-01900

THE HYDROLOGY OF SMALL IMPERVIOUS AREAS, W. Viessman.

Water Resour Res, Vol 2, pp 405-412, 1966.

Descriptors: *Storm runoff, *Hydrographs, Rainfall-runoff relationships.
Identifiers: *Urban drainage, *Urban hydrology, Surface permeability.

A method for computing storm-water run-off from small, impervious, urban areas is described in which consecutive 1-minute unit hydrographs are determined for a storm and summed to provide a total outflow hydrograph. Calculations are based on the assumption that such areas behave as linear reservoirs and take account of the drainage-area lag time and losses due to depression storage. Good agreement was obtained between actual and computed hydrographs, and peak discharges for 30 storms were predicted with an average absolute error of 9 per cent.
W69-01901

PROGRESS REPORT ON THE STORM DRAINAGE RESEARCH PROJECT, JULY 1, 1958, TO JUNE 30, 1959, Johns Hopkins Univ., Dept. Sanit. Eng. Water Resour., Baltimore.

W. Viessman.

Descriptors: *Storm drainage, *Runoff forecasting, Storm runoff, Hydraulics, *Intakes, *Design, *Rain gages, *Weirs, *Flow measurement, *Instrumentation, *Rainfall-runoff relationships, *Rainfall intensity.
Identifiers: *Urban hydrology, *Urban drainage.

In 1949, a research project was initiated in Baltimore, Md., to solve problems connected with urban storm drainage, including the development of a reliable method for predicting storm water runoff. In the first 7 years, the hydraulic characteristics of storm water inlets were investigated, and on the basis of the results, the design of such inlets was modified, a very efficient square grate was designed, and a method was provided for matching the inlet capacity with the drain capacity. New instruments have been developed for measuring and recording rainfall and storm run-off, including a special weir for measuring flows into storm water inlets, and a pressure-type depth-recording system. At present, studies are being carried out on the hydrological relations between rainfall and urban run-off. On the basis of measurements of rainfall and run-off over a period of 4 years, it was concluded that the Rational Method used in designing urban storm drainage systems gives unreliable estimates of the peak rate of run-off, and a new method of design, known as the Inlet method, was developed. This method is based on the maximum 5-minute rainfall intensity at each inlet, and a study has therefore been made of the relation between maximum and short-interval rainfall intensity and the duration of the intense part of a storm. Studies are also in progress to determine the range of applicability and statistical validity of the new method, the effect of antecedent rainfall on the peak discharge for a drainage area, and the timing and attenuation of storm water flows in closed drainage systems.
W69-01902

HYDROLOGIC EFFECTS OF URBAN GROWTH—SOME CHARACTERISTICS OF URBAN RUN-OFF. For primary bibliographic entry see Field 04C. For abstract, see . W69-01903

THE DESIGN OF URBAN SEWER SYSTEMS. RESEARCH INTO THE RELATION BETWEEN RATE OF RAINFALL AND THE RATE OF FLOW IN SEWERS.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01905

TIME IN URBAN HYDROLOGY, For primary bibliographic entry see Field 04D. For abstract, see . W69-01906

PRELIMINARY STUDY OF EFFECT OF URBANIZATION ON FLOODS IN JACKSON, MISSISSIPPI,

For primary bibliographic entry see Field 04C.
For abstract, see .
W69-01907

A METHOD OF URBAN DRAINAGE DESIGN FOR REGIONS OF HIGH RAINFALL INTENSITY,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01910

HARVARD GULCH FLOOD CONTROL PROJECT,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01911

CALCULATION OF DISCHARGE OF RAIN DITCHES AND RAINFALL COLLECTING SYSTEMS,

For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01918

RAINFALL AS AFFECTING FLOW IN SEWERAGE SYSTEMS,

For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01919

RETARDATION OF DISCHARGE IN PUBLIC WATERS WITHIN THE AREA OF A COMMUNITY,

W. Kadner.
Gas-Wasserfach, Vol 109, No 6, pp 158-159, 1968.

Descriptors: *Storm runoff, *Overflow, *Rainfall-runoff relationships, Design, *Drainage systems.

Identifiers: *Combined sewers, *Storm sewers, Urban drainage.

Public waters often serve as the unloading place for rainwater overflows of mixed sewer systems or rainwater mains of separate systems. In sizing such streams, it is difficult to follow the usual corresponding methods for town drainage and Kehr's rainwater run-off diagram does not permit the determination of maximum run-off any more. It is claimed that the method described has the advantage of permitting the determination of run-off at any point in the stream and thus, also, of the respective design flow. Moreover, it makes it possible to add new drainage areas and to determine the volume of the permissible maximum amount and to make corrections for the developed progress line without too much effort.
W69-01920

CONTRIBUTION TO THE DETERMINATION OF THE DIMENSIONS OF RAIN STORAGE TANKS, W. Kadner. Gesundheits-Ing, Vol 88, pp 124-127, 1967.

Descriptors: Rainfall intensity, *Storm runoff.
Identifiers: *Combined sewers, *Storage tanks, *Capacity, *Calculations.

The author compares two methods, the Muller-Neuhau and the Randolph, for the determination of suitable dimensions for storm-water storage tanks in combined sewerage systems. He stresses the importance of determining a progression from observations of rainfall in the place concerned and of referring to this in the calculations; those made for the town of Karlsruhe, Germany, are given as an example, with tables and graphs. No significant difference was found between the results obtained by the two methods, but the Randolph method is more suitable when a series of tanks is to be used.
W69-01921

HYDROLOGICAL AND EFFICIENCY INVESTIGATION METHOD IN CONNECTION WITH ESTABLISHMENT OF DEVELOPMENT RATE OF SURFACE DRAINAGE, G. Kienitz.

Int Commission on Irrigation and Drainage-5th Cong, Tokyo-Trans, Vol 3, pp 15.495-504, 1963.

Descriptors: *Drainage systems, Rainfall-runoff relationships, Discharge (Water).
Identifiers: *Capacity.

Investigations were carried out to establish what channel flood-waves would develop in catchment areas as result of precipitation, depending on discharge capacity of drainage system.
W69-01922

2F. Groundwater

INTRA-ANNUAL DISTRIBUTION OF SUBTERRANEAN FLOW INTO RIVERS, For primary bibliographic entry see Field 02E. For abstract, see . W69-01603

SOME FACTORS AFFECTING BASEFLOW, Illinois State Water Survey, Urbana.

For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01612

ROLE OF A GULLY-RAVINE NETWORK IN THE FEEDING OF GROUND WATER AND METHOD OF DETERMINING ITS AREAS, B. S. Ustyuzhanin.

Translation from Trudy Gos Gidrol Inst No. 139, 1967, pp 224-232. Soviet Hydrol, Selec Pap No 1, pp 56-63, 1967. 8 p, 4 fig, 2 tab, 17 ref.

Descriptors: *Groundwater recharge, *Infiltration, *Snowmelt, *Gullies, *Ravines, *Ephemeral streams, Maps, Estimating, Snow cover, Intermittent streams.
Identifiers: *Water balance studies, USSR, Snowmelt infiltration.

Investigations conducted in various parts of the European USSR show that groundwater recharge through a network of ephemeral streams in ravines, gullies, and gullies, reduces meltwater runoff in spring. Snow is blown off flat areas and collects in ravines, where it protects the ground from freezing. When the snow melts, infiltration occurs first and most rapidly in ravine bottoms where the soil is not frozen as deeply as on the flats. The ratio of snow-filled ravines to bare uplands is not easily determined from presently available topographic maps, but may be estimated from agricultural use maps with plowed-area information, because plowing is done only on upland flats. Ravines occupy from about 9-25% of the surface area in the regions stu-

died. Conversion factors relating ravine network length to area covered for several regions of USSR are tabulated to aid in estimating ravine area where no agricultural use maps are available. (Knapp-USGS)
W69-01630

GROUND-WATER LEVELS IN THE UNITED STATES 1961-65—SOUTHWESTERN STATES.

U.S. Geological Survey, Washington, D.C.

U S Geol Surv Water-Supply Pap 1855, 125 p, 1968.

Descriptors: *Data collections, *Water wells, *Water levels, Water level fluctuations, Observation wells, Arizona, California, Hawaii, Nevada, New Mexico.

Identifiers: Periodic observations.

Water-level data from a network of observation wells in the southwestern U. S. and Hawaii taken between 1961-65 are tabulated. The network of wells in each state is briefly described. Well descriptions, dates of measurement, and water levels are tabulated. A map shows well locations for each state. (Knapp-USGS)
W69-01632

TURBULENT FLOW IN POROUS MEDIA.

Melbourne Univ., Australia, and Water Res Foundation of Australia.

C. E. Kirkham.

Water Res Found of Australia Bull No 11, 146 p, Sept 1967. 6 tab, 31 fig, 94 ref, append.

Descriptors: *Turbulent flow, *Porous media, *Computer programs, Laplace's equation, Darcy's law, Reynolds number, Model studies, Mathematical models, Digital computers, Analytical techniques.

Identifiers: Australia, Experimental Model study.

Turbulent flow in porous media was studied by numerical, model and analog methods to develop a field equation suitable for all porous media flow. Energy loss equations for various types of media were determined and methods of analysis were developed and applied to flow fields such as groundwater flow to wells, flow through and over rockfill banks, and confined flow through right angled bends and sectors. The general equation is applicable to laminar, turbulent or transition flows. Analytical solutions of the equation are presented for simple boundary conditions and compared with solutions using Laplace's equation to illustrate the inaccuracy of the Laplace method when Darcy's law is not obeyed. For complicated boundaries, a digital computer program for IBM 7044 is presented and a FORTAN listing is included. The equation was verified with a model study. The model was a gravel-filled 90 deg miter bend with unequal long and wide legs. (Knapp-USGS)
W69-01648

AQUIFER RECHARGING,
For primary bibliographic entry see Field 04A.
For abstract, sec .
W69-01826

2G. Water in Soils

STEADY INFILTRATION FROM BURIED POINT SOURCES AND SPHERICAL CAVITIES,

CSIRO Division of Plant Industry, Canberra, Australia.

J. R. Philip.

Water Resources Vol 4, No 5, pp 1039-1047, Oct 1968. 9 p, 6 fig, 15 ref.

Descriptors: *Infiltration, *Unsaturated flow, *Porous media, *Mathematical studies, Soil moisture, Hydraulic conductivity, Capillary conductivity, Darcy's law, Diffusion.

Identifiers: Point source infiltration, Spherical cavity source infiltration, Quasilinearization.

An analysis is given of unsaturated flow regimes of prolonged infiltration into regions of deep water table from point sources and from spherical cavities. The analysis is simplified by assuming that it does not involve a free surface. Hydraulic conductivity is represented by an exponential function of moisture potential and the nonlinear steady flow equations is transformed into a linear equation formally equivalent to the equation for diffusion in a moving medium. The point source solution is extended to the analysis of infiltration from spherical cavities. Although the rate of infiltration from cavities with small or dimensionless radius is determined mainly by capillarity, gravity distorts the moisture distribution pattern strongly, whatever the cavity radius. (Knapp-USGS)
W69-01614

A SOLUTION FOR VERTICAL INFILTRATION INTO A DRY POROUS MEDIUM,

Cornell Univ., Ithaca, New York.

Wilfried Brutsaert.

Water Resources Res, Vol 4, No 5, pp 1031-1038, Oct 1968. 8 p, 4 fig, 1 tab, 9 ref.

Descriptors: *Infiltration, *Unsaturated flow, *Porous media, *Mathematical studies, Soil moisture, Hydraulic conductivity, Diffusivity, Diffusion, Capillary conductivity, Darcy's law.

Identifiers: *Vertical infiltration.

An exact solution is presented for the second term of the series expansion of the numerical solution of the concentration-dependent diffusivity equation of J R Philip. The use of simple algebraic functions describing the water content-capillary suction and water content-capillary conductivity relationships of porous media makes the exact solution possible. Terms higher than second order are negligible because of fast convergence. Use of a previous solution for the first term of the expansion together with this solution for the second term is a satisfactory method of calculating vertical infiltration. The method was found to be in good agreement with results of infiltration experiments on Columbia silt loam. (Knapp-USGS)
W69-01615

INFLUENCE OF THE PHYSICAL AND CHEMICAL PROPERTIES OF SOIL ON MEASUREMENTS OF WATER CONTENT USING NEUTRON PROBES,

Vincenzo Cotecchia, Angelo Inzaghi, and Enzo Pirastru.

Water Resources Res, Vol 4, No 5, pp 1023-1028, Oct 1968. 6 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Soil moisture meters, *Nuclear moisture meters, *Calibrations, *Neutron absorption, *Porous media, Measurement, Soil water, Pervious soils, Soil groups.

Identifiers: Neutron flux soil moisture meters, Neutron capture cross sections, Multigroup transport theory.

The influence of soil physical and chemical properties on neutron probe soil water measurement was studied by using multigroup transport theory to calculate thermal neutron flux at various water contents in each soil studied. The media considered are siliceous sand, limestone, dolomitic limestone, and terra rossa. Although elements with high capture cross sections were not present, the media behaved differently in neutron moderation, diffusion, and capture, so that probe response was variable at equal water content in rocks of the same dry density. Interpretation of the results without knowing the effect of the media is not reliable. Agricultural soils, however, show no such differences in neutron behavior. (Knapp-USGS)
W69-01616

THE STEADY-STATE MEASUREMENT OF THE RELATION BETWEEN HYDRAULIC CONDUCTIVITY AND MOISTURE CONTENT IN SOILS,

Sydney Univ., N. S. W., Australia.

For primary bibliographic entry see Field 07B.
For abstract, see .
W69-01625

2H. Lakes

GEOLOGICAL STUDIES OF LAKE MICHIGAN,

Michigan Univ., Ann Arbor, Great Lakes Research Div., Inst. of Science and Tech.

Jack L. Hough.

Part of final report of USPHS Grant WP-00311. Spec Rep No 30 of Great Lakes Res Div, pp 228-246, 1967. 19 p, 12 fig, 1 tab, 2 ref. ONR-104-818.

Descriptors: *Lake Michigan, *Topography, *Geologic investigations, *Lake beds, Cores, Dredging, Maps, Sediments, Seismic studies, Radioactive dating, Lake stages.

Identifiers: *Bedrock framework, Sub-bottom profiles, Topographic maps.

The topography and geology of the bottom of Lake Michigan were studied by sounding, seismic profiling, and dredging samples. A topographic atlas consisting of four section maps, scale 1:120,000 are published, and quadrangles of scale 1:31,680 were constructed for this study. A 3-dimensional model of the lake basin is under construction. Core samples were taken to investigate sediments in the upper few ft of the bottom with particular emphasis on learning about late glacial to recent depositional changes, particularly changes resulting from human activity. Study of the cores shows that the lakes was relatively barren until a slight degree of eutrophication began just before civilized man reached the area, and eutrophication has continued until the present. Almost no evidence of civilization can be seen in core samples. Core logs also show a low water stage between 10,000 and 4,200 years ago, when the water surface was 350 ft below present lake level. Radiocarbon dating of bottom materials is in progress. (Knapp-USGS)
W69-01619

WATER QUALITY AND EUTROPHICATION TRENDS IN SOUTHERN LAKE MICHIGAN,

Michigan Univ., Ann Arbor, Great Lakes Research Div., Inst. of Science and Tech.

Charles F. Powers, and John C. Ayers.

Part of final report of USPHS Grant WP-00311. Michigan Univ Spec No 30 of Great Lakes Res Div, pp 142-178, 1967. 37 p, 6 tab, 10 fig, 14 ref. ONR-104-818.

Descriptors: *Data collections, *Chemical analyses, *Lake Michigan, *Eutrophication, Water quality, Silica, Calcium, Magnesium, Sulfates, Chlorides, Phosphorus, Nitrates, Biological properties.

Identifiers: *Macrobiotics, Chicago, Milwaukee, Grand Rapids, Whiting, Michigan City.

Chemical analyses of water from municipal water system intakes in the southern part of Lake Michigan were used to study recent trends in water quality and eutrophication. The intakes of the water systems of Grand Rapids, Chicago, and Milwaukee supplied most of the samples, and Whiting and Michigan City supplied a few of less value. The longest record period is 1926-present, at Chicago. Calcium and Magnesium were chosen as standards of comparison because human activity should have little effect on their concentrations. Regression lines in plots of analyses show no significant changes with time. Sulfate, chloride, and total solids are increasing. Silica is decreasing, possibly because of increasing diatom growth with increasing lake productivity. Phosphorus fluctuates markedly at Chicago but open-water samples show no trend. Generally, shore values of all analyses agree very well with open lake values. Dissolved solids, particularly those put in the lake by human activity, are increasing. Other studies show corresponding biological changes that have occurred within the lake. The changes are probably associated with the environmental alteration evident in the long-term change in concentrations of ions and other solids. (Knapp-USGS)

Field 02—WATER CYCLE

Group 2H—Lakes

W69-01623

STUDIES OF MILWAUKEE HARBOR AND EM-BAYMENT.

Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.

For primary bibliographic entry see Field 05C.

For abstract, see .

W69-01649

THE INTERNAL DISTRIBUTION OF ANALYSIS VALUES AS AN INDICATOR OF EUTROPHICATION,

Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.

For primary bibliographic entry see Field 05C.

For abstract, see .

W69-01650

THE GRAND RIVER AND ITS PLUME IN LAKE MICHIGAN.

Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.

John C. Ayers, and Ronald Rossman.

Michigan Univ Spec Rep No 30 of the Great Lakes Res Div, pp 366-371, 1967. 6 p, 3 fig, 2 tab, 2 ref.

Descriptors: *Dispersion, *River flow, *Lake Michigan, Turbidity, Temperature, Conductivity, Color, Dissolved oxygen, Water pollution effects. Identifiers: *Dispersal plume, Grand River (Michigan).

The discharge and mixing of the Grand River, Michigan, into Lake Michigan were studied by sampling the river at 3 stations and taking 7 turbidity samples from the plume of river water in the lake. The river water quality is influenced by several cities and was brown and stained with what appeared to be humic material. Its turbidity ranged from 34.0 ppm to 84.5 ppm. Dissolved oxygen was 8.1 mg/l and 97% saturated. River water conductivity was 550 micromhos/cc at the end of the breakwaters and lake water conductivity was 277. River water temperature was 23.0 deg C while lake water temperature was 18-19 deg. The dispersion plume was mapped by calculating percentage river water at 7 stations on the basis of turbidity, temperature, and conductivity. The studies indicate that dispersal plume study may provide good information on the behavior of nearshore lake waters. (Knapp-USGS)

W69-01651

THE SURFICIAL BOTTOM SEDIMENTS OF LAKE MICHIGAN,

Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.

John C. Ayers.

Michigan Univ Spec Rep No 30 of the Great Lakes Res Div, pp 247-253, 1967. 7 p, 4 fig.

Descriptors: *Bottom sediments, *Lake Michigan, *Lake beds, Sediments, Clays, Sampling, Maps, Benthic fauna, Lake soils. Identifiers: Eutrophication-caused sediment change.

Descriptions of 875 sediment samples taken from the bottom of Lake Michigan are compiled on maps scaled about 10 mi per in. The samples were taken about every 1-5 mi along lines perpendicular to shore, about 5-15 mi apart. The sediments were classified by visual inspection, odor, feeling the fresh samples, and examination with a binocular microscope. (Knapp-USGS)

W69-01652

TEMPERATURE STRUCTURE OF LAKE MICHIGAN,

Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.

Vincent E. Noble.

Michigan Univ Spec Rep No 30 of the Great Lakes Res Div, pp 340-365, 1967. 25 p, 1 fig, 4 tab, 3 ref.

Descriptors: *Lake Michigan, *Water temperature, Thermocline, Thermal stratification, Computer programs, Digital computers. Identifiers: *Temperature structure.

Bathythermograph data for Lake Michigan were put on computer cards and processed by computer. The thermal structure of the lake is presented in tables giving temperature-depth relationships for each month of 1963-1966 at each station listed by latitude and longitude. The computer program used is described, discussed, listed. Conspicuous features in the results are that the summer period when the thermocline exists lasts from the middle of June to the middle of November, and the deep water is warmest at the fall mixing at the end of November or really December. (Knapp-USGS)

W69-01653

JOHNSON V SEIFERT (RIPARIAN OWNER'S RIGHT TO USE OF ENTIRE LAKE SURFACE).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01929

ANNUAL GROWTH CYCLE, GROWTH POTENTIAL, AND GROWTH COMPENSATION IN THE BLUEGILL SUNFISH IN NORTHERN INDIANA LAKES,

Indiana Univ., Bloomington. Dept. of Zoology.

Shelby D. Gerking.

J Fish Res Board Canada, Vol 23, No 12, pp 1923-1956, 1966. 34 p, 7 fig, 6 tab, 54 ref.

Descriptors: *Secondary productivity, *Sunfishes, *Growth rates, Indiana, Lakes, Productivity, Fish, Period of growth, Indicator organisms, Thermoperiodism, Photoperiodism, Feeding rates.

Identifiers: *Bluegills, *Lepomis, Sylvan Lake, Carr Lake, Maxinkuckee Lake, Spear Lake, Crooked Lake, Ridinger Lake, Pretty Lake, Growth hormone, Glacial lakes, High Lake.

Eight lacustrine populations of bluegill sunfish with widely varying growth rates exhibited a surge of growth in spring followed by a progressive decline in late summer and autumn. Growth rate declined as age increased; in no case did growth of an older age group exceed that of a younger age group in the same year. Length of growing season (period between annulus formation and achievement of 90% annual growth) varied among lakes and between years in same lake (mean: 152 days; range: 98 (Ridinger L)-189 (Maxinkuckee L)). In Ridinger L, season extended a month longer in 1963 than in 1962, but this difference was not evident in other lakes. When ranked according to growth rate of resident fish, each lake retained same position in both 1962 and 1963. Populations experiencing longer growth seasons grew more rapidly than those with shorter seasons. Author presents evidence that all populations demonstrated approximately equal growth potential as judged by weight increment of fish of group III. Growth compensation may result from earlier inception of growth in smaller fish. Author reviews possible explanations of annual growth cycles as related to temperature, photoperiod, and interactions between growth hormone and seasonal feeding rates. (Wis)

W69-01976

DUVAL V THOMAS (RIGHT TO REASONABLE USE OF LAKE SURFACE).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01992

LEATHERSICH V NEW YORK STATE WATER RESOURCES COMM'N (ADMINISTRATIVE DECISIONS).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01998

2I. Water in Plants

ALBEDO OF INTERCEPTED SNOW,

Northeastern Forest Experiment Station and Syracuse Univ., College of Forestry, Syracuse, New York.

Raymond E. Leonard, and Arthur R. Eschner.

Water Resources Res, Vol 4, No 5, pp 931-935, Oct 1968. 5 p, 4 fig, 2 ref.

Descriptors: *Interception, *Snow, *Albedo, *Evaporation, Energy budget, Radiation, Water loss, Conifers, Red pine trees. Identifiers: Intercepted snow loss, Solar altitude.

Incident and reflected shortwave radiation above a red pine plantation was measured at 30-minute intervals for 2 days after a 12-in. snowfall to determine whether enough energy is absorbed to evaporate a significant amount of the intercepted snow. Maximum albedo was less than 20% of incident radiation, compared with the 70-90% for fresh snow on the ground and commonly assumed to apply also to intercepted snow. Energy available for evaporation of intercepted snow may be 4 times the amount previously assumed. As intercepted snow aged, albedo decreased and eventually approached summer values when snow left the upper part of the canopy. With an albedo of 0.20 a net solar radiation of 36 langleys per hour caused evaporation of 0.6 mm water per hour, or 2.00 mm per day, showing that a considerable amount of intercepted snow may be lost to evaporation. (Knapp-USGS)

W69-01598

CONVERSION OF HARDWOOD-COVERED WATERSHEDS TO WHITE PINE REDUCES WATER YIELD,

Southeastern Forest Experiment Station, Asheville, N. C.

W. T. Swank, and N. H. Miner.

Water Resources Res, Vol 4, No 5, pp 947-954, Oct 1968. 8 p, 6 fig, 1 tab, 17 ref.

Descriptors: *Water yield, *Forests, *Reforestation, *Interception, *Watershed management, Coniferous forests, Deciduous forests, White pine trees, Canopy, Demonstration watersheds. Identifiers: Southern Appalachians.

Mixed mature hardwoods were cleared from two Southern Appalachian experimental watersheds and the cleared areas were planted with eastern white pine to determine the effect of forest composition on runoff. When the pine crowns began to close, streamflow steadily declined at a rate of 1 to 2 in. per year. By 1967, water yield was 3.7 in. less from a 10-year-old pine stand on a southfacing watershed than expected water yield from the original hardwood forest. Most of the water yield reduction occurred during the dormant season and was attributed mainly to greater interception loss from white pine than from hardwoods. Because interception differences increase as white pine matures, an even greater reduction in streamflow is expected. (Author)

W69-01624

2J. Erosion and Sedimentation

FLOOD SURGE ON THE RUBICON RIVER, CALIFORNIA--HYDROLOGY, HYDRAULICS AND BOULDER TRANSPORT,

U.S Geological Survey, Washington, D. C.

For primary bibliographic entry see Field 02E.

For abstract, see .

W69-01610

RELATION OF SEDIMENT LOAD TO HYDROLOGICAL CHARACTERISTICS OF

Water Yield Improvement—Group 3B

CONNECTICUT RIVER BETWEEN NORTHFIELD AND SPRINGFIELD, MASSACHUSETTS,
Massachusetts Univ., Amherst, Dep of Geology.
Miles O. Hayes.

Mass Univ, Water Resources Res Center Symp Proc, Publication No 3, pp 53-61, June 2, 1967, 9 p, 1 fig, 3 tab, 2 ref.

Descriptors: *Sediment load, *Connecticut, River basins, Bed load, Suspended load, Depth, Velocity, Dams, Massachusetts, Laboratory tests, Particle size.

Identifiers: Connecticut River, Geologic controls.

The sediment load of the Connecticut River, the largest river in New England, is being studied. Geographic and geologic settings are described. A longitudinal profile of the river from Turners Falls Dam to Holyoke Dam was drawn. Velocity measurements and mean diameter of the bed load are plotted. North of Amherst, Mass, the predominant bed load is gravel, and south of Amherst it is sand. Partial analyses of sediment sizes from the main channel and tributaries are tabulated. (Knapp-USGS)

W69-01637

FALL VELOCITY OF IRREGULAR SHAPED PARTICLES,

Michigan Technolog Univ., Houghton, and Colo. State Univ., Ft. Collins.

George R. Alger, and Daryl B. Simons.

ASCE Proc, Jour Hydraul, Vol 94, No HY3, Paper 5949, pp 721-737, May 1968. 17 p, 11 fig, 4 tab, 6 ref, 2 append.

Descriptors: *Particle shape, *Settling velocity, *Hydraulics, Fluid mechanics, Particle size, Flow separation, Vortices, Sediments, Reynolds number, Resistance.

Identifiers: *Shape factor, *Fluid flow, Drag, Vortex formation, Particle motion, Fluid viscosity.

The importance of surface area and volume of particles in sediment fall velocity is determined and a particle shape factor is developed that includes these variables. Free-fall velocity of variously shaped particles in fluids of different viscosity is determined. A shape parameter is proposed which correlates Reynolds number with drag coefficient to describe the motion of irregular shapes. This results in a useful Reynolds number-drag coefficient relation. Data for analysis were collected from tests of natural gravel-sized particles of various shapes and sizes supplemented by larger geometric shapes. The basic motions-sliding, tipping, and rotation-of particles in free fall may occur separately or be combined depending on such causes as flow separation and vortex formation. (Lang-USGS)

W69-01640

THE SURFICIAL BOTTOM SEDIMENTS OF LAKE MICHIGAN,

Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.

For primary bibliographic entry see Field 02H.

For abstract, see .

W69-01652

RAND V MILLER (ACTION TO QUIET TITLE TO ACCRETION LANDS SEPARATED FROM RIPARIAN LANDS BY AVULSION).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01951

ROLE OF SILT IN WATER POLLUTION,

R. D. Walker.

Amer Water Works Ass J, Vol 58, No 11, pp 1483-1488, Nov 1966. 6 p, 2 tab, 1 fig, 6 ref.

Descriptors: *Illinois, *Silts, Water pollution sources, Agricultural watersheds, Surface runoff,

Erosion, *Erosion control, *Gully erosion, Sheet erosion, Desilting, Sedimentation, Conservation, Dams.

Silt is defined as any soil material carried by moving water or deposited as sediment. The amount of silt reaching a reservoir or treatment plant can be reduced by soil conservation practices within the watershed. The two major kinds of soil erosion are gully erosion and sheet erosion. Gully erosion occurs where water flow is concentrated while sheet erosion carries away a thin layer of soil with each rain. Soil erosion occurs in two phases: (1) the impact of the rain breaking loose soil particles and (2) surface runoff carrying away the particles. Erosion may be held to a minimum by reducing the impact, usually with a vegetative cover, and minimizing runoff speed. On agricultural land this may be accomplished by proper crop rotation and contour farming. A universal equation has been developed by the Soil Conservation Service to figure soil losses in a given watershed before a conservation project and to compare them with probable losses afterwards. Urban construction also causes much soil loss. Dams constructed on the Missouri River have proved effective in reducing silt, as have other projects under the Watershed Protection and Flood Prevention Act and in the conservation districts which exist in all Illinois Counties. (Kahle-Fla)

W69-01968

2K. Chemical Processes**WATER QUALITY AND EUTROPHICATION TRENDS IN SOUTHERN LAKE MICHIGAN,**
Michigan Univ., Ann Arbor, Great Lakes Research Div., Inst. of Science and Tech.

For primary bibliographic entry see Field 02H.

For abstract, see .

W69-01623

GROUNDWATER CONTAMINATION AND HYDROCHEMICAL FACIES OF SHALLOW AQUIFERS IN MASSACHUSETTS,
Massachusetts Univ., Amherst, Dep of Geology.
Ward S. Motts.

Mass Univ, Water Resources Res Center Symp Proc, Publication No 3, pp 29-38, June 2, 1967. 10 p, 1 fig, 5 tab, 5 ref.

Descriptors: *Groundwater, *Water quality, *Geochemistry, Aquifers, Salinity, Iron, Chlorides, Massachusetts, Geohydrologic units.

Identifiers: Hydrochemical facies, Groundwater contamination.

The chemical quality of water in shallow aquifers in Massachusetts was studied to learn the variation of quality caused by geology, geomorphic location, and contamination. About 40% of the wells studied are on floodplains, 16% above floodplains, 11% in swamps, 15% near lakes, and 18% on flats. The highest concentrations of Fe and Mn are near groundwater discharge areas and the lowest are in recharge areas. Most groundwater in the state is in the acidic facies, associated with non-calcareous rocks. The alkaline facies of western Massachusetts is associated with limestone; in the Connecticut valley the alkaline facies contains more sulfate and is associated with Triassic basalts and redbeds. In eastern Massachusetts an alkaline facies is associated with the Salem Gabbro. Mineralization is increasing slightly in the wells sampled. Over 50% of the wells sampled showed increases in Cl from 1955-66. 50% of those near discharge areas doubled in Cl, but none contain over 150 ppm Cl. The increase is caused by salt used for highway snow removal, drainage from dumps, septic tank pollution, and other causes. (Knapp-USGS)

W69-01639

2L. Estuaries**TURBIDITY MAXIMUM OF THE NORTHERN CHESAPEAKE BAY,**
Johns Hopkins Univ., Baltimore, Maryland, Chesapeake Bay Inst.

J. R. Schubel.

Science, Vol. 161, pp 1013-1015, Sept 6, 1968. 3 p, 2 fig, 10 ref.

Descriptors: *Estuarine environment, *Turbidity, *Suspended load, Streamflow, Rivers, Bay, Sediment distribution, Flocculation, Particle size, Circulation.

Identifiers: *Turbidity maximum, *Chesapeake Bay, Tidal cycles.

The turbid zone from head Chesapeake Bay at Turdley Point seaward for 32 km was comprehensively studied in 1966-67 and results are summarized. Samples collected fortnightly from several depths at each of 15 stations were analyzed for concentration of total suspended solids, combustible organic matter, the mineralogy, and size distribution of suspended particles. Other samples were collected at stations farther seaward in the estuary, and at several anchor stations where hourly measurements of current velocity, suspended sediment concentration, temperature, and salinity were made over 2 or more tidal cycles. Extensive size analyses of river and bay samples by a photomicrographic method and by a sediment technique failed to show any evidence of either flocculation or deflocculation of river-borne sediment. The turbidity maximum near the head of Chesapeake Bay is produced mainly by local resuspension of bottom sediments, and by the estuarine 'sediment trap' formed in the upper part of the estuarine circulation regime by the net nontidal circulation. (Land-USGS)

W69-01600

INTERNAL IMPROVEMENT TRUST FUND.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01933

INTERNAL IMPROVEMENT TRUST FUND.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01934

INTERNAL IMPROVEMENT TRUST FUND.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01935

MATZOK V GLEN COVE YACHT SERVICE REPAIR, INC. (EASEMENT OF ACCESS TO NAVIGABLE PORTION OF STREAM).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01943

03. WATER SUPPLY AUGMENTATION AND CONSERVATION**3B. Water Yield Improvement****GEOLOGIC FACTORS IN COMMUNITY DEVELOPMENT AT NAPERVILLE, ILLINOIS,**
Illinois State Geological Survey, Urbana.

J. E. Hackett.

Environ Geol Notes No 22, 16 p, June 1966. 4 fig, 11 ref.

Descriptors: *Planning, *Illinois, *Water resources development, City planning, Long-term planning, Flood plain zoning, Local governments, Urbaniza-

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3B—Water Yield Improvement

tion. Water quality, Municipal water, Groundwater, Surface waters, Aquifers, Reservoirs.
Identifiers: *Physical environment, DuPage County (Illinois), Area development, Chicago suburbs, Geologic factors.

A planning study conducted by a citizens' committee of the Naperville Community Council reviewed the role of the physical environment in the development of an expanding community. Data on geology, groundwater resources, streamflow and extent of flooding are compiled. The city grew from 12,933 in 1960 to 18,734 in 1966; this has resulted in expansion of water, sewage disposal, and storm water drainage control facilities. The city is on the West Branch DuPage River which has an average flow of 50 cu ft per sec and carries waste from upstream sources. There is little possibility that surface water reservoirs of sufficient size will be developed because valleys are shallow, relief in the area is generally low, and streamflow is low. Groundwater supplies are available from sand and gravel deposits, the dolomite bedrock, and from deep sandstones. Present municipal wells include 4 in the dolomite and 1 in the deep sandstones. Total pumpage is 1.5 mgd, or about 75 gal per capita. The hardness is 400 to 500 ppm, but the water is free of bacterial pollutants. (Knapp-USGS) W69-01594

3C. Use of Water of Impaired Quality

PLANNED CITY PLANS TO RE-USE STORM RUNOFF.

Environ Sci Technol, Vol 1, No 11, p 875, Nov, 1967.

Descriptors: *Water reuse, *Storm runoff, *Water pollution control, Equipment, Sewage treatment.
Identifiers: *Storage tanks, *Urban drainage, *Columbia (Md).

A plan to store storm water locally, thus controlling pollution, and then to amortize construction costs by reusing the water for high-volume needs is being studied in the planned city of Columbia, Maryland. The plan calls for collecting rain runoff in neighborhood reservoirs, or even in mass produced storage basins for individual residences. Methods and equipment for treating the water to make it suitable for non-drinking purposes are also being studied.
W69-01759

USE OF STORM RUNOFF FOR ARTIFICIAL RECHARGE.

For primary bibliographic entry see Field 04B.
For abstract, see .
W69-01864

FUTURE WATER QUALITY DESIGN,

California State Department of Public Health, Berkeley.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-01982

3D. Conservation in Domestic and Municipal Use

WATER PRICING IN RESIDENTIAL AREA,

For primary bibliographic entry see Field 06C.

For abstract, see .

W69-01986

CHALLENGES IN THE WATER INDUSTRY,

Raymond J. Faust.

Journal of the American Water Works, Vol. 55, No. 6, June 1963, pp 661-667, 3 ref.

Descriptors: Water resource management, Municipal water supply, *Water quality control, Water rates, Standards, Revenue, Peak load, Research and development, Adoption of practices, Water quality, Administration, Administrative decision.
Identifiers: *Water utility industry, Water service, Consumer needs, American Water Works Association.

The water industry today faces many challenges. Service is the keystone of the water utility industry and excellent service must always be the goal. Inadequate planning is the main cause for inefficient service, causing deficiencies in one or more of the major facilities of a water system - that is, in source, treatment, pumping, transmission, storage, and distribution. Water quality, as measured by technical standards and consumer needs, is also one of the major areas needing research and improvement. To achieve the goal of quality water for the consumer a new water standard promulgated by the industry, through AWWA, will be needed. Many of the deficiencies of these two areas of service and quality can be ascribed to insufficient revenue. As the only significant source of revenue of a water utility is the sale of water, it becomes obvious that such sales should be based on rates that will yield sufficient money to operate and maintain the system, pay debt service, employ a competent staff and keep the plant up to date to meet peak loads and operating emergencies. The key to superior consumer service is the improvement of all the above mentioned factors, but this can only come from total management. Without qualified management it is impossible to meet the challenges of the industry. (Gar-gola-Chicago)
W69-01989

3F. Conservation in Agriculture

A STUDY OF EVAPORATION SUPPRESSANTS UNDER GREENHOUSE CONDITIONS: EVALUATION 1 AND 2,

South Plains Research and Experiment Center, Lubbock, Tex.

C. W. Windt, and J. R. Runkles.

Tex A and M Univ, Agr Exp Sta Progr Rep PR 2510 and PR 2542; 10 p, 13 p; Feb 9, 1968; May 15, 1968. 8 fig, 1 tab, 4 ref; 10 fig, 3 tab, 1 ref.

Descriptors: *Evaporation control, *Soil moisture, *Chemcontrol, *Oil, Air-earth interfaces, Water loss.

Identifiers: Crude oil, Polysaccharides, Anions, Cations, Latex.

Crude oil and crude oil plus additives including an anionic, a cationic, a nonionic, an oil-latex mixture and a polysaccharide-gum mixture were evaluated as evaporation suppressants on an Olton loam soil under greenhouse conditions. The 150-gallon-per-acre rates of crude oil was superior to a 50-gallon-per-acre rate. Evaporation was further suppressed when a cationic, oil-latex mixture and a polysaccharide-gum mixture were added to the 150-gallon-per-acre rate of crude oil. In some cases, the anionic enhanced suppression when it was added to crude oil but not as much as the cationic, oil-latex mixture or polysaccharide-gum mixture. The nonionic apparently decreased the ability of soil to suppress evaporation. An attempt was made to create a dry barrier on the soil surface using a propane flame. However, the moisture was replenished as fast as it was evaporated so that a dry layer was never created. (Knapp-USGS)
W69-01595

EVAPORATION FROM BOGS, DEPENDING ON CLIMATE, DRAINAGE, AND CULTIVATION (RUSSIAN),

A. I. Ivitskii.

Translation from Gidrotekh i Melior No 1-2, pp 62-66, 1968. TT67-51385 6 p. Issued by CFSTI.

Descriptors: *Wetlands, *Bogs, *Soil physical properties, *Soil chemical properties, Soil water plant relationships, Evaporation control, Runoff, Drainage effects.

Identifiers: *USSR, *Bog drainage, Marsh hydrology.

Results and conclusions of calculations previously made for undrained, drained, and cultivated bogs in the USSR are reviewed. The evaporation values obtained from the 1932-34 experiments on peat soil were carried out in evaporators of cross section 25 X 4 cm and 100 cm height. Also presented are experimental results from the Institute of Bog Management. These experiments were carried out with lysimeters on the Minsk bog station. An 0.8 X 0.8 m cross-section lysimeter in which the peat was arranged in layers, was used; evaporation was determined by the volumetric method. It was concluded that evaporation from the peat soil without ground cover at shallow water table is higher, and at deep water table it is lower than the sum total of rainfall during the summer. Moreover, bog evaporation is lower than evaporation from the water surface. A drained but uncultivated bog evaporates about half the water evaporated by an undrained bog, but cultivated grasses in a drained bog reduces evaporation as compared with undrained conditions. Thus, drainage of bogs without subsequent cultivation increases total runoff. (L-laverias-USGS)
W69-01627

RELIEVING OVERLOAD ON TAMWORTH SEWAGE WORKS.

For primary bibliographic entry see Field 05D.

For abstract, see .
W69-01686

DEVELOPMENT OF IRRIGATION DISTRICTS.

For primary bibliographic entry see Field 06E.

For abstract, see .
W69-01965

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on THE Surface

PRINCIPAL HEIGHT ZONES OF STREAMFLOW FORMATION IN CENTRAL ASIA IN DIFFERENT MONTHS OF THE GROWING SEASON,

For primary bibliographic entry see Field 02C.
For abstract, see .
W69-01601

UNIFORM FLOOD-FREQUENCY ESTIMATING METHODS FOR FEDERAL AGENCIES,

U.S. Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01609

SMALL WATERSHED STORAGE USING LOW DAMS,

Massachusetts Univ, Amherst, Dep of Civil Engineering.

For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01636

SEEPAGE THROUGH AN EARTH DAM COMPUTED BY THE RELAXATION TECHNIQUE,

Stanford Univ., Stanford, California.

E. J. Finnemore, and Byrne Perry.

Water Resources Res, Vol 4, No 5, pp 1059-1067, Oct 1968, 9 p, 6 fig, 1 tab, 13 ref.

Descriptors: *Seepage, *Earth dams, *Homogeneity, Levee, Mathematical studies, Darcys law, Methodology, Computer models, Permeability, Steady flow, Phreatic lines.

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Control of Water on the Surface—Group 4A

Identifiers: *Relaxation technique, Free streamline.

An investigation is made of the problem of seepage through a homogeneous earth dam or levee assuming the flow is plane, steady, and governed by Darcy's law. The Laplace equation is used as the governing equation for the pressure head, with straightforward boundary conditions except at the phreatic surface. This surface is a free streamline whose location is initially unknown. Solution of the problem is reached by adopting the relaxation method for machine computation. Solutions obtained for separate executions having widely different initial positions of the streamline agreed closely. The solutions required from 50 to 70 seconds on an IBM 7090, and they agree well with the longhand computations of Shaw and Southwell. The computer flow rates agree closely with the theoretical discharge of the Dupuit formula. Variations in permeability, which are difficult or impossible to deal with by classical methods, can easily be incorporated into the computation scheme. (Lang-USGS)

W69-01641

BUILT TO BE SEEN,

Wilsey and Ham, San Mateo, Calif.

For primary bibliographic entry see Field 08C.

For abstract, see .

W69-01675

THEORETICAL CONSIDERATION OF SIDE WEIRS AS STORM WATER OVERFLOWS,

For primary bibliographic entry see Field 08B.

For abstract, see .

W69-01677

HYDRAULIC DESIGN OF STORM SEWAGE OVERFLOWS INCORPORATING STORAGE,

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01678

LABORATORY STUDIES OF STORM OVERFLOWS WITH UNSTEADY FLOW,

P. Ackers, A. J. M. Harrison, and A. J. Brewer.

Symp on Storm Sewage Overflows, May 1967.

Descriptors: *Storm runoff, *Overflow, *Weirs, *Stilling basins, *Model studies, Instrumentation, Water pollution, *Chemical analysis.

Identifiers: *Suspended solids.

Models of four types of typical overflows: (1) a low side weir, (2) a stilling pond, (3) a vortex with central spill, and (4) a storage overflow with high side weir, were tested at two pipe slopes, 1:500 and 1:100. The model overflows were installed in turn at the downstream end of the pipe. The salinities of the base flow, the spilled water and water passed to treatment were measured by electrical conductivity meters. Suspended and floating materials were introduced into the pipe by screw-feed injector, heavier material being put in by hand upstream. Solids were collected by sieves. The tests were divided into two categories: (a) those investigating the discharge of dissolved pollution and (b) those studying the behavior of bed load and suspended and floating solids. Each structure was first tested with saline-base flow and fresh-water storm waves of 1, 2, 3, and 4 mins. duration. Recorder charts were analyzed for each structure and the duration of each test in turn, to obtain the discharge time curves shown. The proportions of pollutants spilled to the wave duration are shown by graphs as well as the average concentrations of pollutants in the spill as proportions of a base flow concentration each for salt, polystyrene, bakelite, polythene, and polythene with scum boards.

W69-01679

PRELIMINARY GUIDANCE FOR THE CALCULATION AND DESIGN OF STORM-SEWAGE

OVERFLOWS IN COMBINED SEWAGE SYSTEMS.

W69-01695

Abwassertechnische Vereinigung, 1962. 26 p.

Descriptors: *Overflow, Rainfall-runoff relationships, *Design.

Identifiers: Storm sewers, *Combined sewers.

Based on existing information on rainfall and runoff in sewerage systems, preliminary measures are suggested for the calculation and design of storm-sewage overflows by determining the critical intensity of rainfall at which an overflow first occurs, which is illustrated by nomograms. This method of calculation is not as straightforward as the existing dilution process but it has the advantage that predictions can be made on both the frequency of operation and the duration of the overflow. It is these criteria which determine the state of pollution in the receiving water and permit a uniform and even treatment of the storm-sewage overflow in a cross section of the channel. This confirms the usefulness of this method, since heavy rainfall in sewerage systems can be retained, thus reducing the polluting load on the receiving water.

W69-01682

KENT SEWERAGE WORKS FOR 9000 PEOPLE.

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01683

CHICAGO STUDIES PLAN FOR CONTROLLING COMBINED SEWER OVERFLOWS.

For primary bibliographic entry see Field 05D.

For abstract, see .

W69-01689

METHOD OF AND MEANS FOR DEALING WITH STORM-WATER OVERFLOWS IN SEWERS AND LIKE DRAINAGE SYSTEMS.

Longwood Engineering Co., Ltd.

For primary bibliographic entry see Field 05D.

For abstract, see .

W69-01690

TECHNICAL COMMITTEE ON STORM OVERFLOWS AND THE DISPOSAL OF STORM SEWAGE.

For primary bibliographic entry see Field 05D.

For abstract, see .

W69-01691

STORM WATER OVERFLOWS. THE USE OF SIPHONS AT IPSWICH,

R. N. Barrett.

J Instn Munic Engrs, Vol 85, pp 33-42, 1958.

Descriptors: *Overflow, *Siphons, Weirs, *Storm runoff.

Identifiers: *Combined sewers.

The author describes experiences at Ipswich in the design and operation of siphon overflows for removal of excess storm water from combined sewerage systems. Siphon overflows are considered to have certain advantages over the more commonly used side-weir overflows.

W69-01692

DESIGN OF UNDERWATER STORM WATER OVERFLOW STORAGE SYSTEM,

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01693

DRAW-DOWN AND OTHER FACTORS RELATING TO DESIGN OF STORM-WATER OVERFLOWS ON SEWERS,

For primary bibliographic entry see Field 08A.

For abstract, see .

AN INVESTIGATION OF HEAD LOSSES AT SEWER MANHOLES.

P. Ackers.

Civ Eng, London, Vol 54, 1959.

Descriptors: *Manholes, *Head loss, Overflow, Sewers.

The author describes the results of experiments on factors affecting head losses at sewer manholes. It was found that head losses at open invert manholes are small except when surcharge occurs and hatch-box manholes are no better except under surcharge conditions.

W69-01697

THE HYDRAULIC RESISTANCE OF DRAINAGE CONDUITS.

For primary bibliographic entry see Field 08B.

For abstract, see .

W69-01698

TABLES FOR THE HYDRAULIC DESIGN OF STORM-DRAINS, SEWERS, AND PIPE-LINES,

For primary bibliographic entry see Field 08B.

For abstract, see .

W69-01699

POLYMER COAGULATORS.

Environ Sci Technol, Vol 1, No 2, p 111, Feb 1967.

Descriptors: *Flow control, Storm runoff.

Identifiers: *Polymers, *Combined sewers, *Capacity.

The research division of the Western Co. is studying the feasibility of adding polymer coagulators to combined sewer-storm lines to enable them to carry greater quantities of sewage during rains. The additives increase fluid flow in pipes by reducing turbulent friction loss. If the method proves feasible, demonstration tests will be conducted in the Dallas-Fort Worth area in mid-1968.

W69-01701

HYDRAULIC DESIGN OF DEPRESSED CURB-OPENING INLETS,

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01702

STORM WATER TANKS WITHOUT GRADIENTS, A METHOD OF IMPROVING THE SEWERAGE SYSTEMS OF TOWNS,

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01708

OPTIMUM DESIGN OF SEWERS,

For primary bibliographic entry see Field 08B.

For abstract, see .

W69-01710

DEEP TUNNEL SYSTEM GETS OFF THE GROUND.

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01712

ASCE SEWER PROJECT CONTINUES.

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01713

COMPUTERS TO CONTROL COMBINED SEWERS.

Environ Sci Technol, Vol 1, No 10, p 777, Oct. 1967.

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

Descriptors: *Computer program, *Overflows, Storm runoff, *Automatic control, Sampling.
Identifiers: *Combined sewers, Urban drainage.

The Minneapolis-Saint Paul Sanitary District is working on a \$1.7 million demonstration project to use a process control computer to control combined sewer overflows. When heavy rainfall causes the sewers to overflow, the excess is diverted into the river through gates in the sewers. The computer will be used to see that the most polluted flow goes to the treatment plant and the cleaner water to the river. The system will rely on data telemetered from 28 sampling stations to the computer at the plant. The data will include the amount of rainfall, sewer levels, and gate positions. Using simulation techniques, sewage plant operators can determine the best settings on control gates to get maximum pollution to the plant and minimum pollution to the river.

W69-01716

DRAINAGE (SEWERAGE).

For primary bibliographic entry see Field 08B.
For abstract, see .
W69-01718

DRAINAGE (SEWERAGE).

For primary bibliographic entry see Field 08A.
For abstract, see .
W69-01722

STORM-WATER OVERFLOWS FROM COMBINED SEWERS.

H. H. Benjes, P. D. Haney, and O. J. Schmidt.
J Water Poll Control Fed, Vol 33, p 12, 1961.

Descriptors: *Storm runoff, *Overflow, *Rainfall-runoff relationships.
Identifiers: *Combined sewers, Kansas City (Mo.), *Interceptor sewers.

Advocate using peak dry-weather flow rather than average dwf in determining a ratio for interceptor sewers. This helps decrease the per cent difference in peak to average DWF found because of size of community. Agreement with other investigators that from 0.03 to 0.04 in./hr is needed to wet down area before run-off. Each 0.01 in./hr will produce run-off equal to DWF. In Kansas City it was found that measurable rainfall occurred about 5 per cent of the time. Of this 3.7 per cent of the time run-off could occur. With a peak dwf of 1.5 x ave. dwf and a interceptor capacity of 1.5 x ave DWF it was found-overflow would occur 3.72 percent time = to peak dwf. If interceptor was increased to 3.5 ave dwf, overflow would still occur 3.22 per cent of time and 6.5 x ave dwf 2.3 per cent of time. Authors conclude that the practical maximum effective capacity of interceptor can not be much larger than the peak dwf. Also recommend more work be done in characteristics of storm water runoff.

W69-01726

PRINCIPLES FOR CALCULATING FLOWS IN SEPARATE AND COMBINED SEWERS.

For primary bibliographic entry see Field 08B.
For abstract, see .

W69-01727

INFILTRATION INTO SEWERS.

For primary bibliographic entry see Field 08B.
For abstract, see .
W69-01732

EXFILTRATION TESTING OF LARGE SEWERS.

For primary bibliographic entry see Field 08B.
For abstract, see .

W69-01733

HANDLING SANITARY SEWAGE AND STORM WATER, ROUND TABLE DISCUSSION.

Wastes Eng, Vol 31, No 4, p 215, April 1960.

Descriptors: *Storm runoff, Sewers, Settling basins, *Equipment, *Maintenance.
Identifiers: *Combined sewers.

Primarily interested in effect of storm water on flushing out of sanitary lines with resulting loss of effectiveness of grit chambers and overloading of settling tanks. Essentially an operational forum on equipment usage and effects on maintenance.
W69-01734

ESTIMATING THE CAPACITY OF SEWERS AND STORM DRAINS.

P. Ackers.
Munic Eng, London, Vol 142, p 170, 175, 1965.

Descriptors: *Sewers, *Storm drains, Pipes, Flow measurement, Slime.
Identifiers: *Capacity.

Recent investigations on sewer capacities, conducted at the Ministry of Technology, Hydraulics Research Station, are summarized. Experiments using clean, salt-glazed, precast concrete, and pitch-fibre pipes confirmed the validity of the Colebrook-White friction formula (but not the Crimp and Bruges or Manning equations), and also showed that pitch-fibre pipes, when clean, have an hydraulic capacity 5-10 per cent greater than the others. The effect of imperfect joints in salt-glazed pipes on the roughness coefficient was found to be directly related to the degree of eccentricity and the spacing of the joints. To investigate the effect of slime layers, flow-velocity measurements were made in 20 sewers of various ages, materials, sizes and gradients, and the roughness coefficients were calculated. The results, which are tabulated, indicate that slime layers form quite rapidly in sewers, and that the roughness factor increases with increasing thickness of the layer, giving a corresponding reduction in capacity.
W69-01751

PROVIDE DRAINAGE BEFORE FLOODS OCCUR.

Amer City, Vol 75, p 2, 1960.

Descriptors: *Storm runoff, *Water pollution, *Storm drainage, Pumping, Sewage treatment, Sewers.
Identifiers: *Storm sewers, *Urban drainage.

Present sewerage facilities serving the Counties of Macomb and Wayne, Michigan are grossly inadequate. The area is drained by Milk river which is very slow flowing and sometimes stagnant, and a rapid increase in population resulting in an increase in the volume of storm water has augmented the problem. A project to improve the sewerage facilities, started in September 1958, includes the construction of two pumping stations, a main pumping station with skimming and sedimentation tanks located about 3/4 mile upstream from the mouth of the Milk river and a low-lift pumping station about 1/2 mile downstream from the main pumping station. Radial gates have been installed in the river so that the water between the two stations can be changed when necessary. The new Milk river sewer, although designed primarily for storm water use, will carry a small quantity of sewage during storm periods. Under normal dry weather conditions all sewage is discharged to the Wayne County interceptor system and then to the Detroit sewage-treatment plant.
W69-01753

FLOOD RELIEF PROJECT IN LONDON SUBURB.

Civ Eng and Public Wks Rev, Vol 63, No 744, p 761, July 1968.

Descriptors: *Surface drainage, *Tunnels, *Construction, Manholes, *Velocity, Outlet, *Flood control.

Identifiers: *Sewer flushing, *London (Great Britain), *Storm sewers.

In an effort to relieve flooding in the London Borough of Redbridge a new system of surface sewers was constructed in a tunnel about 30 ft. below ground level. Access shafts were constructed of 11 ft. internal dia. reinforced concrete bolted segments. On completion of tunnelling operations they were converted into drop-manholes to transfer the excess flow from the existing system down into the new tunnel system. In addition to the connections to the existing system it was necessary to include a number of drop-manholes in the scheme since it was felt that the gradients of the new sewers should be designed so that the velocity of flow would be kept below 12 ft. per second to prevent excessive abrasion of the tunnel by grit, etc. It was found that the amount of noise produced by the flow in the drop-manholes has been low and no complaints have been received even though the manholes are sited in the road outside residential property. The flow passes down a vertical cast iron pipe into water cushion at the bottom of the shaft. The water cushions have proved successful since although there is a build up of grit and debris at low flows, at peak flows the debris is disturbed and flushed down the pipe to the outfall. The water cushions are designed in such a way that they will not choke up with debris during prolonged low flow conditions.
W69-01754

NEW SEWERAGE FOR CROYDON.

Civ Eng and Public Wks Rev, Vol 63, No 743, p 666, June 1968.

Descriptors: Sewers, *Tunnels, *Construction.
Identifiers: *Storm sewers, *Capacity.

The Borough of Croydon on the border of Surrey has been carrying out a program of new building, including commercial development, which has raised a demand for additional sewage capacity. Accordingly, foul water and storm water sewerage has been laid down. The tunnel for the new sewers was sunk at a depth of 40 ft. below street level and was constructed of precast concrete segments. Tunnel diameters varied between 6 ft. and 7 ft. In the former, the foul water channel was of 24 in. dia. and of 27 in. dia. in the remainder.
W69-01755

STORM SEWER DESIGN AND ANALYSIS BY COMPUTER.

Consulting Engr (London), Vol 30, No 7, pp 78, 81, July 1966.

Descriptors: *Design, Overflow, Outlets, Computer programs.
Identifiers: *Storm sewers.

Three ways in which computer program can solve problems related to storm sewer design and analysis; in analyzing existing system for each pipe, output contains indication of overloading, together with measure of surcharge; by redesigning existing system, program analyzes existing system and, if any pipe is surcharged, it indicates surcharge and calculates correct size for that pipe by adding small increments to cross sectional area; new system design in which each pipe is considered separately, outfall of pipe under consideration being taken as outfall of network upstream of this point.
W69-01757

HIGHWAY BRIDGE MEN BUILD TUNNEL-FOR WATER.

Eng News Rec, Vol 174, No 15, pp 34-6, Apr 15, 1965.

Control of Water on the Surface—Group 4A

Descriptors: Drilling equipment, *Tunnel construction, Storm drains, Outlets.
Identifiers: Storm sewers, Urban drainage.

Construction of 4.29 mi. bored trunk storm drain for Interstate Route 280 in New Jersey that is depressed through Newark, East Orange and Orange; drain will carry water from these areas to outfall in Passaic River; sewer has circular cross section 8-ft. in diam, its wall is 1-ft-thick cast-in-place concrete; for 3.86 mi., its depth below existing ground level ranges from 35 to 73 ft. and averages about 60 ft.
 W69-01768

UTILIZATION OF STREAM FOR STREAM DAMAGE.

Public Works, April 1967.

Descriptors: *Drainage systems, *Storm drains, Sewers, Storm runoff.
Identifiers: *Urban drainage.

A municipality is legally liable for defects and obstructions in sewers and drains whether a natural watercourse is adopted for drainage purposes or an artificial channel is built. A legal case illustrating this point is discussed wherein the city was proved liable for water damage when a rainstorm backed up waters in a stream used as part of the city's storm drainage system.
 W69-01760

STANDARDS FOR STORM-WATER FACILITIES.

Pub Works, Vol 91, No 2, p 91, 1960.

Descriptors: *Standards, *Storm runoff, Design, Maintenance.
Identifiers: *Storm sewers, *St. Louis (Mo.), *Urban drainage.

The new standards for storm-water channels, established by the St. Louis Metropolitan Sewer District in order to reduce erosion and reduce maintenance costs and to provide definite data for storm sewer and ditch design, are outlined with the aid of diagrams.
 W69-01761

FLOOD RELIEF SCHEME FOR WEST LONDON.

Surv, Vol 122, No 3728, p 1429, Nov 16, 1963.

Descriptors: Pumping, Storm runoff.
Identifiers: *Storm sewers, London (England).

Extensions to existing flood relief system in West London include Hammersmith storm relief sewer and pumping station; new station will contain 8 electrically driven 42-in.-diam pumps with total capacity of 1500 tons/min; just before pumping station, 6-ft and 2 8-ft sewers will combine into approach channel 24 ft wide and 120 ft long which will house penstocks and screens to protect pumps.
 W69-01763

SURFACE WATER AND SUBSOIL DRAINAGE.

British Standards Institution, London, 1952.

Council for Codes of Practice for Buildings, British Standard Code of Practice CP 303, 1952.

Descriptors: *Storm drains, *Design, *Surface drainage, *Rainfall intensity.
Identifiers: *Storm sewers, Urban drainage, *Surface permeability, Storage tanks.

In this Code of Practice on drainage, recommendations are made for the collection and disposal of rain water and subsoil water, particularly by sewers and drains from small housing estates and in-

dividual dwellings. Factors to be considered in the design of surface-water drainage systems so that pipes are self-cleaning are the intensity and duration of rain fall and permeability of surfaces. Procedure is given for disposal of water in sewerage system or to soakaways, streams, or storage vessels. Subsoil water is defined as the portion of rainfall that is absorbed in the ground and its drainage is required to increase the stability of the surface and workability of soil and to reduce flooding. The laying of field drains and mole drains is dealt with in relation to local conditions.
 W69-01765

A GUIDE FOR ENGINEERS TO THE DESIGN OF STORM SEWER SYSTEMS, PREFACED BY THE REPORT OF THE JOINT COMMITTEE ON RAINFALL AND RUN-OFF OF THE ROAD RESEARCH BOARD AND THE MINISTRY OF HOUSING AND LOCAL GOVERNMENT.

Dep Sci Indus Res, Road Res Lab, London, Road Note No 35, 1963.

Descriptors: *Design, *Hydrographs, *Hydraulic properties, Sewers, Pipes, Computer programs, *Runoff, *Rainfall intensity.
Identifiers: *Storm sewers, *Lloyd-Davies formula.

This publication is intended to guide engineers in the use of the 'rational' (Lloyd-Davies) formula and the Road Research Laboratory hydrograph method (see Wat. Pollut. Abstr., 1962, 35, Abstr. No. 2151) for designing storm sewage systems. The 'rational' formula is recommended for use in areas where the diameter of the largest sewer is unlikely to exceed 24 inches, while the R.R.L. hydrograph method is applicable to all areas. The calculations involved in the hydrograph method are carried out by means of an electronic digital computer. Data on rates of rainfall and the hydraulic characteristics of sewer pipes are included. The publication is prefaced with a report of the Joint Committee on Rainfall and Run-off of the Road Research Board and the Ministry of Housing and Local Government, dealing with origins of the research, constitution and terms of reference of the committee, and the work being carried out.
 W69-01766

SMALL UNDERGROUND DRAINS AND SEWERS: I AND II.

Dept of Scientific and Indus Res, Build Res Sta, Dig Nos 124 and 125, 1959.

Descriptors: *Design, *Construction, *Sewers.

These Digests, which supersede Digest No. 55 (1953), contain advice on the design and construction of drains and sewers, revised on the basis of recent studies. Part I deals with structural design, and Part II with watertightness, flexible joints, site work, and testing.
 W69-01767

STORM DRAINAGE SYSTEMS.

Navy Bureau of Yards and Docks, Washington, D.C., 1956.

Descriptors: *Storm drains, *Storm runoff, Subsurface drainage, *Design, *Construction, *Maintenance.

This revised publication presents in detail basic information on the design, construction and maintenance of storm drainage systems used at naval establishments in the U.S.A. and abroad. Although sub-surface drainage factors are presented, a subsurface system should be required only when excess water cannot be otherwise removed.
 W69-01769

MANUAL FOR URBAN PLANNING - CHAPTER V: INDUSTRIAL LAND PLANNING.

J. Byron Barber.

ASCE Proc, J Urban Planning Devel Div, Vol 93, No UP3, pp 1-13, Sept, 1967.

Descriptors: *Planning, *Drainage systems, Surface runoff, *Storm runoff.
Identifiers: *Urban drainage.

Two aspects of industrial land planning are presented: (1) the urban planner responsible for ascertaining amounts, kinds, and locations of industrial land in the general plan; and (2) the industrial land planner responsible for selection and formulation of a plan for a specific site for a manufacturing plant. It is emphasized that the principles, objectives, methods, and standards described herein apply to both aspects. Sewage problems are briefly discussed. Costs depend on the characteristics of the land and on the type of industry. Storm drainage and surface runoff should be separated from industrial and domestic wastes.
 W69-01770

ECONOMICS OF URBAN DRAINAGE DESIGN, W. J. Bauer.

ASCE Proc, J of Hydr Div, Vol 88, No HY6, pp 93-114, 1962.

Descriptors: Land use, Design storm, *Storm runoff.

Identifiers: *Urban drainage, *Storm sewers, *Chicago (Ill.), Capacity.

Problem of urban drainage viewed as one of space allocation. Storm sewers need a system of controlling location of volumes of water that occupy space in a watershed during and after periods of excessive rainfall. Principles are illustrated by application to Chicago Metropolitan Area during storm of July 1957. Idea of measuring performance of conveyance system in terms of dollars/cfs in transporting water is introduced and some sewer costs given. Planning criteria for urban drainage given: design storm, future urbanization, multiple-purpose projects, storm sewer capacity, assessing benefits, regulation of use of flood plain.
 W69-01771

MANUAL ON URBAN PLANNING - CHAPTER III: RESIDENTIAL LAND PLANNING,

George C. Bestor.

ASCE Proc, J. Urban Planning Devel Div, Vol 93, No UP2, pp 27-92, June 1967. George C. Bestor and Assoc., Inc, Carmel, Calif.

Descriptors: *Planning, Land use, Storm drains, *Drainage systems, *Storm runoff.

Identifiers: *Urban drainage.

Residential land planning is going through an era of drastic change. The creation of a better living environment is a major challenge to planners. Engineers are needed as specialists supporting planning activities, and as qualified planners. Many concepts in planning are being increasingly employed, such as: clustering, density zoning, open space, recreational features. Careful consideration of economics is essential to a successful planning activity. No matter how well planned, a project can fail to obtain approval from sponsors or from governing authorities if it is poorly explained and presented. Storm drainage should be planned in the early stages of a project development. Several methods of dealing with stormwater are outlined.
 W69-01772

STORM SEWER TUNNEL IN ST. PAUL, J. W. Bird.

Civil Eng, Vol 33, pp 51-53, Sept 1963.

Descriptors: *Tunnels, Construction, Construction costs.

Identifiers: *Storm sewers, *St. Paul (Minn.), 'Mole' tunneling.

St. Paul's storm sewer tunnel involved building 4,800 ft. of 10-ft. tunnel with 12-in. walls and 1,200 ft. of 7-ft. tunnel and 900 ft. of 6-ft. tunnel with 9-

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Group 4A—Control of Water on the Surface

in. walls. The cost was \$2,120,852. There are three 36-in. one 4-ft., and one 8-ft. dropshafts. Four 10-in. alignment holes were drilled to a depth of 70 ft. below the tunnel. These holes acted as inverted walls and were used to lower the water table and to provide construction needs. A 20-ft. long mechanical mole excavated a 12-ft., 3-in. opening for the 10-ft. tunnel. Excavated material was transported to a slurry box, mixed with water to constitute 20% solids, and pumped out. Dust problems were solved by a water-spray and air-exhaust system. Placing forms and pouring concrete closely followed the excavation. Only 110 to 200 ft. of unlined tunnel was permitted. A pneumatic concrete placing machine was replaced by a Pumpcrete machine that cut concrete placement time in half. Vibrators in the concrete plus some vibration in the forms gave excellent results.

W69-01773

TORONTO CONFRONT OUTDATED SEWERS,

F. T. Booth, N. Vardin, and G. L. Ball.

Water Poll Control Fed J, Vol 39, No 9, p 1557, Sept 1967.

Descriptors: *Storm runoff, *Water pollution control, Construction, *Overflow, Highways.

Identifiers: *Combined sewers, Toronto (Canada),

*Capacity, *Storm sewers.

Toronto's combined sewer system is inadequate to handle the flows generated by storms. A program to correct this problem is now under way. Separation of sanitary waste flows and drainage is required in all new buildings. It was determined that a stormwater capacity of about 1.5 times dry-weather flow provides substantial reduction in pollution from storm overflows without excessive cost. Construction of shallow storm sewers will be undertaken to first intercept road and other land runoff and later to receive separate drainage flows from buildings as redevelopment takes place. The proposed system ultimately will protect against the storm with a return period of one year.

W69-01774

THE MAUNGARAKI DEVELOPMENT,

R. G. Brickell.

New Zealand Eng, Vol 23, No 3, pp 95-100, March 15, 1968.

Descriptors: *Storm runoff, Flood control, Discharge (Water).

Identifiers: *Urban drainage, *Capacity.

A development of hilly land for housing in the Wellington area of New Zealand, known as the Maungaraki Development, is described. Problems arising from the development include finance, erosion control, compaction control, and removal of unsuitable materials. The disposal of stormwater runoff was complicated by the limitation of peak runoffs reaching the main storm-water system (the Western Hills culvert) to the capacity of the culvert. The problem was solved by the use in the two main valleys of flood control dams, which store the flood waters and let them discharge at a controlled rate. The ponds are carefully fenced off and are provided with 'leaks' at a low level, which ensure that they dry out a few days after rain. The second flood control dam, in Percy Creek, was constructed by the Petone Borough Council to a design prepared by Clime, Spencer, and Associates, consulting engineers to the Petone Borough Council.

W69-01775

RETENTION BASIN ELIMINATES NEED FOR COSTLY STORM SEWERS,

F. W. Crane.

Eng News Rec, Vol 143, No 25, pp 38-42, 1949.

Descriptors: *Flood control, *Storm runoff, Pumping.

Identifiers: *Storm sewers, Buffalo (N. Y.),

*Storage tanks, Capacity.

To prevent flooding from overloaded storm sewers in Buffalo, New York, it is planned to store excess storm water in a disused quarry which has a capacity of 2,350,000 cu ft. The water will then be pumped gradually into the sewers and so discharged into the creek.

W69-01777

STORM WATER DETENTION IN URBAN AREAS,

Eugene J. Daily.

Pub Works, Vol 92, pp 146-147, Jan 1961.

Descriptors: Storm runoff, Drainage system.

Identifiers: *Urban drainage, *Storage tanks.

Give some cost estimates of savings in drainage systems by using detention basins.

W69-01778

DESIGN STORM HYETOGRAPHS FROM STUDIES OF RAINFALL IN THE WESTERN AREA OF SIERRA LEONE,

E. J. Davies, N. J. Garber, and A. E. Harleston.

J Inst of Water Engrs, Vol 20, No 1, pp 67-74, Feb 1966.

Descriptors: *Design storms, *Drainage systems, *Rainfall intensity, Design, Storm, *Hydraulic design.

In Sierra Leone, the design of stormwater drains, spillways, and similar structures whose geometric and hydraulic properties must be related to precipitation frequency, intensity, and duration has largely been based on conjectural storm characteristics. The object of the study was to produce predesign information applicable to the design of stormwater drains and similar structures.

W69-01779

DESIGN OF SURFACE-WATER SEWERS,

L. B. Escritt.

CR Books Ltd, London, 1964. 64 pp.

Descriptors: *Design.

Identifiers: *Storm sewers, Calculations.

In this monograph, which is largely based on a previous paper by Escritt, L. B., and Young, A. J. M., with modifications in the light of further research, recommendations are made for the economical design of surface-water sewers. After a critical review of previous practice, experience, and research, with particular reference to errors resulting in the considerable over-sizing of sewers, the theory is re-examined in the light of recent field studies, leading to the development of a simple, rapid, and accurate method for designing sewers of more economical sizes. Examples are given comparing the new method with the original Lloyd-Davies method. A list of references is provided.

W69-01781

SURFACE WATER DRAINAGE CALCULATION BY DIGITAL COMPUTER,

J. G. Evans.

Survur, London, Vol 121, pp 1436-1437, 1962.

Descriptors: *Surface drainage, *Computer programs, Runoff, Rainfall intensity.

Identifiers: *Calculations.

The author has devised a computer programme for calculating the drainage requirements of any area (involving pipe sizes not exceeding 33 inches in diameter), based on the conventional Lloyd Davies formula. The computer has been used successfully to record rainfall and run-off measurements for the drainage areas of Cwmbran new town.

W69-01782

CALCULATION OF STORM-SEWAGE TANKS,

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01783

MAIN DRAINAGE FOR SKELMERSDALE NEW TOWN,

D. H. Garside.

J Instn Munic Engrs, Vol 93, pp 26-27, 1966.

Descriptors: Sewers, *Hydrographs, Sewage treatment, Sewage effluent, Design.

Identifiers: *Combined sewers, *Sewer separation, *Storm sewers.

The sewerage system for Skelmersdale New Town, Lancs., has been designed on a separate system and, wherever possible, existing combined sewers will be replaced by separate foul and surface-water systems. After making a comparison between the Road Research Laboratory Hydrograph, and the Lloyd-Davies method of design for surface-water sewers, it was decided to adopt mainly the Lloyd-Davies method, but the R. R. L. method was used to produce the hydrographs required for the design of the balancing lakes. There are three types of temporary treatment plant in use: one, a package-type extended-aeration plant; the second, an extended-aeration plant using diffused air; and the third, a conventional filter plant using 'Flooc' medium. The final effluent is discharged to the river Tawd. A fourth plant is planned, in the event of further housing development or an increase in industrial flow; this will involve primary sedimentation, land treatment, and clarification of the final effluent through a gravel bed, and the effluent will be discharged to the river Tawd. The main sewage works which is being constructed will provide complete treatment by the activated-sludge process with Simear aeration cones, and the effluent will be discharged to the river Douglas.

W69-01784

MAIN DRAINAGE OFLEYTON,

J. B. Glover.

Chartered Mun Engr, Vol 91, No 2, pp 59-63, Feb 1964.

Descriptors: *Sewers, *Design, Surface runoff, Outlets.

Identifiers: *Storm sewers.

Proposed improvement scheme for sewer system in Leyton, England, includes construction of trunk foul water and surface water sewers and 3 short spurs, and reconstruction of main outfall system; basis of design.

W69-01786

MANUAL ON URBAN PLANNING - CHAPTER VI: COMMUNITY FACILITIES PLANNING,

Herbert A. Goetsch.

ASCE Proc, J Urban Planning Devel Div, Vol 93, No UP3, pp 15-42, Sept 1967.

Descriptors: Sewage treatment, *Flood control, *Planning, Storm runoff, *Drainage systems.

Identifiers: *Urban drainage.

Community facilities are those buildings, works and land areas which are devoted to public or semi-public uses. Included in this category are public works and utilities to provide water, power, heat, light, communications, sewage treatment, flood control, and transportation. In planning for community facilities, the urban planner must consider population characteristics and projections, present and future land use, local governmental structures, climate, topography, soil, and vegetation. He must consider a community's objectives and financial ability, as well as the standards of the using agencies. Community facilities may be provided by a local community alone, jointly by several units of government, by higher levels of government, by utility companies, and by private and semi-private agencies. These facilities should be planned jointly since their uses are often complementary and space can be conserved. Problems of flood control and stormwater drainage systems are discussed. Providing adequate stormwater drainage must be considered an important part of urban planning. Economic and engineering aspects of the problem are outlined.

W69-01787

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CONSIDERATION OF STORAGE CAPACITY IN STORM-WATER SEWERS,
J. F. Gruhler.
Gesundheits-Ing, Vol 84, 1963.

Descriptors: Design, *Instrumentation, *Flood control, *Storm runoff.
Identifiers: *Storm sewers, Capacity.

The author describes the design of a storm-water sewer equipped with special throttles which can be arranged so as to use the total storage capacity of the sewer and at the same time control the volume of storm water leaving the system to avoid flooding. The exact position and size of these throttles must be determined experimentally, since there is at present no known method for calculating them. The principle of the design is based on the establishment of equilibrium conditions, the flow of storm water entering the system being equal to the storage capacity of the system minus the storm water leaving it, and this depends on the sewer being filled to a certain depth.

W69-01788

ON-THE-SPOT TESTS CHECK GUTTER CAPACITY,
G. H. Hamlin, and J. Bautista.
Am City, Vol 80, No 4, pp 94-6, April 1965.

Descriptors: Flow measurement, *Surface runoff, *Overflow, Design storm, *Inlets.
Identifiers: *Street gutters, *Capacity.

Water-carrying capacity of street gutters in San Leandro, Calif was tested and it was found that practical flows are 1/2 to 1/4 of maximum calculated flows; measurements show that overflows occur substantially below maximums found in tables or calculated by formula; overflows are caused by vehicles parked at curb and driveway openings; tests also measured curb inlet and grating performance; catchbasins are now installed wherever design-storm flow reaches half-way up vertical curb face on all street grades up to 5%.

W69-01789

THE USE OF LAKES IN CONNECTION WITH SEWAGE DISPOSAL,
L. B. Escrict.
Water Waste Treatment J, Vol 7, 1959.

Descriptors: *Surface runoff, *Storm runoff, Outlets, *Flow control, *Lakes, Sewage treatment.
Identifiers: *Capacity, Great Britain.

The author discusses the discharge of partially-treated sewage and of storm water to lakes. Experiences in various countries are quoted, and it is concluded that, with reasonable precautions, lakes could be used in England for the storage of surface run-off without causing nuisance. The design and installation of a module to regulate the outflow from the storage lake to a stream is discussed, and a method and formulas are given for calculating the required storage capacity of a lake in terms of the frequency of storm and rate of outflow from storage.

W69-01814

PROBLEMS IN THE PLANNING OF SEWAGE WORKS,
A. Horler.
Schweiz A Hydrol, Vol 19, 243, 1957.

Descriptors: *Sewage effluent, Sewage treatment, *Overflow, *Storm runoff, *Water pollution.
Identifiers: *Storage tanks, *Combined sewers.

The planning of sewage disposal should be based on topographical and not political divisions. Methods of determining the amount of sewage are described. Combined and separate sewerage systems are compared, and the effect on the receiving stream of storm overflows and the improvement obtained by stormwater storage tanks are discussed. The amount of storm water which

should receive complete treatment is then considered.

W69-01824

AQUIFER RECHARGING,
L. T. Hunziker.
Wat Sewage Works, Vol 111, pp 203-205, 1964.

Descriptors: *Groundwater recharge, *Storm runoff, Water pollution.

In a review of recharging of aquifers, various methods are described including diffusion wells and seepage lagoons using settled storm water. The quality of the water for recharge, geological conditions and the dangers of pollution are discussed briefly.

W69-01826

SLUDGE DEPOSITS IN STREAMS FROM STORM WATER OUTLETS,
W. Kiefer.
Neue Deliwa Z, Vol 3, p 71, 1959.

Descriptors: *Storm runoff, *Overflows, *Sewage sludge, Waste dilution.

Identifiers: *Combined sewers, Storage tanks.

The author describes by means of an example a method for estimating the effect of storm-water overflows on sludge deposits in streams. From comparison of overflows of different types it appears that overflows from combined sewerage systems with five-fold dilution add, on a yearly average, less load to the stream than separate systems. Use of storm-water sedimentation tanks, the ideal solution, is not always possible. In general it is unnecessary for such tanks to have a retention period of more than 10 min. The self-purifying power of the stream must be taken into consideration.

W69-01830

OVERFLOWS FROM COMBINED SEWERS IN WASHINGTON, D C,
G. J. Moorehead.
J Water Poll Control Fed, Vol 33, 711, 1961.

Descriptors: *Overflow, *Storm runoff, Estuaries.
Identifiers: *Combined sewers, *Sewer separation, *Washington, D.C., Potomac River.

The older part of Washington, D.C. is served by a combined sewerage system which discharges a mixture of sanitary sewage and storm water into local streams and the Potomac river during each nominal rainfall, while overflows of sanitary sewage sometimes occur during hot dry weather. After a review of the development of the sewerage system, the author outlines a study which was carried out recently to determine the percentage of sanitary sewage flow which is discharged through storm-water overflows. As a result of the study it is planned to provide some separation of sanitary and storm-water sewers, with the majority of the existing storm-water overflows on the combined system remaining in limited acceptable service. This is expected to reduce the amount of sanitary sewage discharging to the watercourses in the area from 3.3 percent to 0.4 percent of the total flow.

W69-01839

THE PERMISSIBLE DILUTION AT STORM WATER OUTLETS,
W. Scharfe.
Wasserw-Wass Techn, Vol 5, p 243, 1955.

Descriptors: *Storm runoff, *Overflow, Outlets, Construction, Water pollution.
Identifiers: *Dilution, Storage tanks.

The author points out that a dilution ratio for storm water overflows of 1:7 may not in all circumstances afford protection to the stream. Local rainfall, by stirring up deposits, may result in the discharge of a liquid more concentrated than normal sewage. Spe-

cial attention must be paid to the construction of the outlets and to the provision of retention tanks. Increasing the ratio would give sewers of uneconomic size.

W69-01833

BALANCING TANKS AND POUNDS IN THE SURFACE WATER DRAINAGE SYSTEM OF HEMEL HEMPSTEAD,
T. H. Carden.
J Inst Munic Engrs, Vol 93, pp 24-25, 1966.

Descriptors: *Surface drainage, *Drainage systems, *Discharge (Water), *Automatic control.
Identifiers: *Storage tanks, *Urban drainage, Capacity.

The author describes further improvements to the new surface-water drainage system already in operation in Hemel Hempstead, Herts. A further pound is under construction to deal with run-off from one of the new development areas and discharge to the river Gade will be regulated by automatic switches; a further balancing tank is also under construction in the Ver catchment area, with a capacity of 1 1/2 mil.ft³. The balancing tanks and their functions are described and it is suggested that considerable saving can be achieved by the use of a storage unit in suitable drainage schemes where existing facilities for disposal are inadequate.

W69-01868

URBAN HYDROLOGY - REDIRECTION,
D. Earle Jones.
Civil Eng - ASCE, Vol 37, No 8, pp 58-62, Aug, 1967.

Descriptors: *Drainage systems, Storm runoff, *Land use.
Identifiers: *Urban hydrology, *Urban drainage.

Inaccuracies of present hydrology methods are outlined. An improvement is suggested wherein the fact that cities have two separate and distinct storm water drainage systems, a 'minor' and a 'major' system would be recognized. The minor system consists of carefully designed closed and open conduits and their appurtenances. The major system is the route followed by flood or runoff waters when the minor system is inoperable or inadequate. Cities today are overdesigning the minor systems. A reasonable design would provide that ordinary vehicular access to properties be impaired no more often than once in 2-10 yrs. Wiser use of natural land conditions when developing the land can obviate extensive storm sewer construction. Examples are given of some methods for this wiser use e.g. 'blue-green' land development employing ponds with open space for storm-flow detention.

W69-01885

STORM RUN-OFF FROM URBAN AREAS,
M. V. King.
Proc Insts Civ Engrs, Vol 37, pp 43-56, Pap No 6996, 1967.

Descriptors: *Storm runoff, Rainfall-runoff relationships, *Sewers, Hydrographs, Drainage systems, Design.
Identifiers: Urban drainage, *Urban hydrology, Surface permeability.

The author describes the development of a mathematical relation between rainfall and run-off in urban areas, taking into account various calculable characteristics of a drainage area and the retention action of a sewerage system as used in the Road Research Laboratory hydrographic method. It is shown that the peak flow for any particular frequency of storm depends on the time of concentration, the effective impervious area, and the total volume of water in the sewerage system at the time of peak run-off; only the last of these is difficult to determine, and for very large areas it is considered adequate to use an approximation. Having determined the retention constant for a drainage system

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under particular conditions, it is also possible to draw the complete run-off hydrograph. This method may be used in designing large sewers, but is not considered suitable for small ones.
W69-01886

ECONOMIC STUDY OF URBAN AND HIGHWAY DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-01887

DETERMINATION OF THE DISCHARGE OF RAIN WATER.
G. Mueller-Neuhaus.
Gesundheits-Ing. Vol 68, pp 143-8, 1947.

Descriptors: *Storm runoff, *Discharge (Water), Sewers.

A graphical method for the determination of the discharge of rain water through sewers taking into account the influence of the gradient and cross-sectional area is described.
W69-01890

STORM WATER DRAINAGE IN THE CHICAGO AREA.
H. P. Ramey.
ASCE Proc, J Hydr Div, Vol 85, No HY 4, Paper No 1995, pp 11-37, 1959.

Descriptors: *Storm runoff, Outlets, Storms, *Storm drainage.
Identifiers: *Urban drainage, *Chicago (Ill).

From a review of past and recent conditions of flooding in the Chicago area, it is concluded that the present outlet channels are inadequate to handle the run-off during heavy storms. Possible methods of improving the situation are indicated and discussed.
W69-01892

FLOODING FREQUENCIES FOR URBAN DRAINAGE DESIGN.
E. S. Rowe, and E. D. Storr.
Australian Road Res, Vol 2, No 10, pp 24-30, Dec 1966.

Descriptors: *Rainfall intensity, *Storm runoff, *Design, Pipes, *Drainage systems, *Highways.
Identifiers: *Urban drainage, Sydney (Australia).

Effects on expected rainfall intensity, run-off, pipe sizes and cost, of using different flooding frequencies for road drainage design are illustrated for situation in Sydney, Australia.
W69-01893

THE HYDROLOGY OF URBAN RUNOFF.
A. L. Tholin, and Clint J. Keifer.
ASCE Proc, J Sanit Eng Div Vol 85, No SA2, p 47, 1959.

Descriptors: *Rainfall-runoff relationships, *Design storm, *Land use, Sewers, *Hydrographs, *Design, Runoff.
Identifiers: *Urban hydrology.

Presented in this paper is a detailed study of rainfall-runoff relationships in urban areas based upon a 'Design Storm' for three hours duration. Several types of uniform land use with various values of ground slope and depression pondage have been studied. Based on the sewer hydrographs, a series of 'easy-to-use' design charts are presented.
W69-01897

PROBLEMS OF WATER DISCHARGE IN URBAN AREAS.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01899

RUNOFF ESTIMATION FOR VERY SMALL DRAINAGE AREAS,
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01900

PROGRESS REPORT ON THE STORM DRAINAGE RESEARCH PROJECT, JULY 1, 1958, TO JUNE 30, 1959,
Johns Hopkins Univ., Dept. Sanit. Eng. Water Resour., Baltimore.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01902

SURFACE WATER DRAINAGE--REVIEW OF PAST RESEARCH.
L. H. Watkins.
Instr Mun Engrs, Vol 78, No 4, pp 301-20, Oct 1951.

Descriptors: *Drainage, *Design, *Surface runoff, Sewers, *Rainfall intensity.
Identifiers: Great Britain, United States, Calculations, *Surface permeability, *Sewer infiltration.

Critical review of principal investigations carried out on drainage in England and U. S.; methods for designing surface water sewers; methods of obtaining design intensities of rainfall by means of local records kept over many years; runoff reaching sewer, expressed by impermeability factor of drainage area; American development of curves showing amount of infiltration.
W69-01904

THE DESIGN OF URBAN SEWER SYSTEMS. RESEARCH INTO THE RELATION BETWEEN RATE OF RAINFALL AND THE RATE OF FLOW IN SEWERS.
L. H. Watkins.
DSIR Road Res Tech Pap No 55, London, 1962.

Descriptors: *Design, Sewers, *Rainfall-runoff relationships, Runoff, *Instrumentation, Storms, *Hydrographs, *Computer programs.
Identifiers: *Urban drainage, *Surface permeability.

A report is given of research carried out by the Road Research Laboratory on the relation between the rate of rainfall and the rate of run-off from urban areas, principally intended to lead to a method for calculating the rate of run-off in sewerage systems that would be accurate and reliable under as wide a range of conditions as possible. Rainfall and run-off were recorded at 12 experimental catchment areas, representing a wide range of sizes, types of development, locality, and other variables; and the rates of run-off calculated from the recorded rates of rainfall by 5 different methods were compared with the recorded rates of run-off. Descriptions are included of the experimental catchment areas and of new recording instruments which were developed for use in these investigations. A total of 286 storms was analysed and it was concluded that the Rational (Lloyd-Davies), Tangent, and Modified Tangent methods for calculating run-off were unreliable for use in the design of sewerage systems, although the Rational method could be used for relatively small areas, such as housing estates and villages, where there are no sewers larger than about 24 inches in diameter. The usual Unit Hydrograph method was also unsuitable for the design of urban sewerage systems owing to difficulties in determining the shape of the unit hydrographs. The Road Research Laboratory therefore devised a new hydrograph method which is reliable under all conditions and will be used in conjunction with an electronic digital computer. It was also concluded that in calculations for the design of sewers, subject to some qualifications in exceptional circumstances, the whole area of paved surface in an urban area should be considered impermeable, and the unpaved areas should be considered completely pervious.

W69-01905

A METHOD OF URBAN DRAINAGE DESIGN FOR REGIONS OF HIGH RAINFALL INTENSITY,
I. R. Wood.
Civ Eng Trans Instn Engrs, Australia, CE1, No 1, p 38, 1959.

Descriptors: *Rainfall intensity, *Design, *Drainage system, *Storm runoff, Design storm, *Hydrographs.
Identifiers: Urban drainage, *Surface permeability.

The author considers that the Rational Method is unsuitable for the design of suburban drainage systems in regions where the design intensity is so high that run-off occurs not only from the impervious area but also from the pervious area, such as lawns and gardens. He suggests that a better method would be to determine a design storm pattern, subtract a loss rate curve, and translate the excess rain into hydrograph form using overland flow equations. The application of the method to conditions in Canberra is described. Approximations are suggested to make it possible to use the procedure for routine design.
W69-01910

HARVARD GULCH FLOOD CONTROL PROJECT,
K. R. Wright.
ASCE-Proc (J Irrigation and Drainage Div), Vol 93, No IR1, paper 5132, pp 15-32, March 1967.

Descriptors: *Flood control, *Model studies, Intakes, *Design, Construction.
Identifiers: *Urban hydrology.

Planning, design, and construction of major urban flood control project is presented; emphasis is placed on flood hydrology investigations used as basis for sizing of culverts, open channels, and structures; information is given on model testing of inlet structure to assure control of rate of flood waters entering outfall culvert; techniques for designing open channels, both concrete and grass-lined, are described; underflow pipes were used to carry normal low flows; planning of construction schedule by design engineer is described, together with methods of construction and results of alternate bids for large diameter concrete pipe and concrete box culvert.
W69-01911

RETARDATION OF DISCHARGE IN PUBLIC WATERS WITHIN THE AREA OF A COMMUNITY,
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01920

KRUPA V FARMINGTON RIVER POWER CO (FLOODING BELOW DAM).

147 Conn 153, 157 A 2d 914 (1959).

Descriptors: Dikes, *Flood damage, Dam construction, *Dam failure, Building codes, Historic flood, Dams, Maximum probable flood, Rainfall-runoff relationships, Watersheds (Basins), Permits, Legal aspects, Floods, *Connecticut, Judicial decisions.
Identifiers: Farmington River, Flashboards.

Plaintiffs owned a farm on the Farmington River about 800 feet below defendant's dam. The farm was extensively damaged when a dike and flashboards which the defendant maintained in conjunction with the dam gave way during the disastrous floods of August, 1955. Plaintiffs based their cause of action in negligence, breach of contract, and nuisance. Defendant had not acquired proper state authorization to build the dam in 1925, but this violation of statute was not actionable because it was not shown to be the proximate cause of the injury. In 1950 the state board for the supervision of dams and dikes did approve of alterations to the headworks and the dikes. There was no error in the lower court's conclusion that the damage was not

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caused by any negligence of the defendant but by an act of God. (McDermott-Fla)
W69-01927

TURNER V WASHINGTON SUBURBAN SANITARY COMMISSION (EASEMENTS AND DISCHARGE OF SURFACE WATERS).

221 Md 494, 158 A 2d 125.

Descriptors: Judicial decisions, *Maryland, *Easements, *Surface runoff, Surface drainage, Water injury, Storm drains, Sewers.

Plaintiff owned property over which a public highway ran, pursuant to an easement. The easement was granted when the area was rural in nature. When the area became suburban, the county built a sanitary sewer and storm drainage system along the highway. Plaintiff brought suit, claiming damages and injunctive relief, on the grounds that the sanitary sewer constituted an additional compensable servitude and that the storm drain concentrated and increased the flow of surface water onto his property, leaving silt and debris deposits. The court held that the laying of the sanitary sewer was within the original easement, and no compensation was necessary. However, the increased discharge of surface water, above the natural flow, was clearly actionable, and the trial court should have granted injunctive relief. (Williams-Fla)
W69-01928

JONES V DES MOINES AND MISSISSIPPI RIVER LEVEE DIST NO 1 (LEVEE DISTRICT'S LIABILITY FOR OVERFLOW).

369 S W 2d 865-869 (Ct App Mo 1963).

Descriptors: Natural streams, *Missouri, *Levees, Drainage systems, *Drainage districts, Pumping plants, Legal aspects, Boundaries (Property), Flooding, Seepage, Surface runoff, Standing waters, Overflow, Soil structures, *Ditches, Mississippi River.

Identifiers: Slough, Levee district.

The plaintiff, owner of property lying adjacent to and in a slough, filed suit against the defendant levee district for damages caused to his land by flooding and an injunction to prevent water from standing thereon. He contended that the district had no right to drain surface water from the surrounding area into the slough and should therefore be held liable for the resulting damage. The trial court denied relief. On appeal it was held, as to the land lying within the slough, that the evidence established that the slough was a natural watercourse thereby entitling the district to collect surface waters and to allow them to flow into that natural draining channel where they would otherwise naturally go. It was further held, as to the plaintiff's property lying outside the slough, that no evidence had been presented to show that the overflows complained of were caused by the defendant's levee. To the contrary, it was established that the water would have overflowed plaintiff's land more often had it not been for the defendant's pumps and levee. (Geraghty-Fla)
W69-01932

EXTINGUISHMENT BY PRESCRIPTION OF NATURAL SERVITUDE FOR DRAINAGE OF SURFACE WATERS,

L. C. Warden.
22 A L R 2d 1047-1059.

Descriptors: *Prescriptive rights, *Surface drainage, Drainage water, Easements, Legal aspects, *Obstruction to flow, Barriers, Natural flow doctrine, Land tenure.

Identifiers: *Servitude.

The right to be free from drainage or natural flow of surface waters may be acquired by prescription. Once the prescriptive right to obstruct the natural flow of water has been acquired, the height of the

obstruction may not be increased over the height of the original obstruction. The taker of a prescriptive right to obstruct the drainage of water must benefit from the result. To extinguish a servitude for drainage of surface waters by prescription, there must be an adverse use by the servient tenement against the owner of the dominant tenement. The prescriptive period does not begin until a right of action arises, but no actual damage need be shown for extinguishment of servitude by prescription when the obstruction of the flow is on the servient tenement, the dominant owner must know about the adverse use. The obstruction must also be continuous and uninterrupted. One claiming extinguishment of servitude by prescription has the burden of proving it. (Sisserson-Fla)
W69-01936

SEC 5E TO ISSUE LICENSE FOR APPLICATION OF CHEMICALS TO WATERS FOR CONTROL OF AQUATIC NUISANCES, ETC. SEC 5F TO CONTROL ALGAE, WEEDS AND AQUATIC NUISANCES IN CERTAIN BODIES OF WATER, ETC.

Mass Ann Laws ch 111 Secs 5E, 5F (1967).

Descriptors: *Massachusetts, *Legislation, Administrative agencies, Plant growth regulators, *Chemicals, Algae control, Weed control, *Aquatic weed control, Nuisance algae, Permits, Ponds, Public health.

Sec 5E provides that no person shall use chemicals in a body of water to control algae, weeds or other aquatic nuisances without first obtaining a license from the Department of Public Health. Such license is valid for two years and may be renewed. It is not transferable or assignable and may be revoked for cause. A board of review is created to hear appeals from decisions of the Department. The Department is authorized to establish rules and regulations for the issuance of such licenses. A penalty is provided for violation of the act. Public employees and owners of private ponds are exempted from the act. Sec 5F authorizes the Department of Public Health to control weeds and algae in such bodies of water as it deems necessary. Public hearings and cost estimates are established to determine the necessity of such projects. (Williams-Fla)
W69-01937

WESTBURY REALTY CORP V LANCASTER SHOPPING CENTER, INC (ARTIFICIAL USE OF LAND GIVES RESPONSIBILITY FOR INCREASED SURFACE WATER FLOW).

396 Pa 383, 152 A 2d 669-672 (1959).

Descriptors: *Pennsylvania, Judicial decisions, *Surface drainage, *Surface runoff, Reasonable use, Natural streams, *Land development, Rural areas, Land tenure, Developed waters.

Identifiers: Water disposal system.

Appellee was a developer of a shopping center. Appellant was a landowner whose property adjoined appellee's land. Appellant brought an action for damages resulting from an increased discharge of surface water from appellee's land, and to enjoin appellee from disposing of such water and to provide an adequate disposal system. A landowner may increase the flow of surface water through a natural waterway as a result of reasonable improvements to his land. The court held that covering 17 acres of land with non-porous materials was an artificial use of the land, and the developers had to take precautions so as not to place the burden of the increased flow of surface waters on adjacent landowners. (Sisserson-Fla)
W69-01940

ROCKWELL V STATE (HIGHWAY DRAINAGE).

182 NYS 2d 422 (Ct Cl 1959).

Descriptors: *New York, *Highways, Judicial decisions, Surface waters, Drainage, *Surface runoff, Drainage effects, State governments, Road banks, Pipes, Surface drainage, *Culverts, Damages.

Identifiers: Highway drainage.

A state highway, which perpendicularly intersects claimant's barn driveway, was resurfaced and claimant was required to remove a drain culvert which was underneath his driveway at the point of intersection. Because of the removal of the culvert, surface water flowing along a shoulder depression of the highway flows into claimants land and is causing damage to his barn. A state engineer testified that the highway was properly constructed. Claimant's expert testified that the state should have installed a pipe under the driveway to carry the drainage along the highway depression. A state is not liable for damage caused by the discharge of surface water which is the result solely of the grading of streets. However, if the state collects surface water into a single channel causing it to overflow onto adjacent land, the owner has a cause of action. Claimant could not recover because the natural topography of the land was responsible for the flow of water onto his land. The proof was insufficient to show that the state had increased the flow onto the land by artificial means. (Molica-Fla)
W69-01941

NOLAN V CARR (MUNICIPALITY'S LIABILITY FOR SURFACE DRAINAGE).

189 N Y S 2d 82-87 (Sup Ct 1959).

Descriptors: *Cities, *Riparian rights, Controlled drainage, Culverts, Roads, *Surface drainage, Remedies, Legal aspects, Judicial decisions, Ditches, Drainage system, *New York.

Plaintiff filed suit to restrain defendant town from maintaining a roadside drainage system which plaintiff alleged had produced a flooded condition and a deposit of soil and dirt on his land. Evidence presented at trial established that plaintiff's farm was located at the bottom of a natural depression and that surface waters from lands lying north, west and east of it would flow upon his land and collect in pools. Construction of the roadway and drainage system on higher land north of plaintiff's premises was found not to have increased the size of that natural watershed. It did, however, have the effect of collecting and discharging the water in mass which otherwise would have flowed in a diffused state upon the plaintiff's land. The mass discharge of collected surface water by a municipality onto a private owner's land is actionable. Liability, however, is not predicated on the mere discharge in a single point but on proof of damage to the owner's land. The court found the plaintiff had failed to prove damage to his land and that the drainage system did not increase the total amount of water which would ordinarily have flowed onto his land. Furthermore, the existence of a culvert under the road, terminating 12 feet from the plaintiff's land, provided opportunity for the diffusion of the water. The injunction was denied. (Geraghty-Fla)
W69-01942

HOLBROOK V MASSACHUSETTS TURNPIKE AUTHORITY (ACTIONS FOR DAMAGES BY LANDOWNER FOR FLOODING CAUSED BY FILLING LAND TAKEN BY EMINENT DOMAIN).

154 NE 2d 605-611 (Mass 1958).

Descriptors: Judicial decisions, *Massachusetts, *Eminent domain, Flooding, Landfills, *Flood damage, Rain water, *Highways, Administrative agencies, Damages, Ponds, Dams, Pipes, Legislation, Overflow.

Landowner brought a proceeding against the turnpike authority, which had taken part of his land by eminent domain for the construction of a turnpike, to recover for damage to his land as a result of flooding. The flooding occurred after very heavy rainstorms, allegedly because of fill dumped by a

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contractor working on the turnpike. The Supreme Court held that the landowner could maintain a proceeding to recover for the damage under the statute creating the turnpike authority, if the damage was due to the performance of the work as authorized, but not if the damage was a result of an act of God, or due to the contractor's negligence or other unauthorized acts or omissions, in which case the landowner was required to seek redress in a tort action. The burden of proof was on the landowner to prove by a fair weight of credible evidence that his land was damaged or destroyed in the carrying out or in the exercise of powers granted the turnpike authority by statute. (Watson-Fla)
W69-01949

BLUMER V WISCONSIN RIVER POWER CO. (LANDOWNER'S SUIT AGAINST DOWNSTREAM DAM OWNER FOR RAISING THE WATER TABLE).

6 Wis 2d 138, 94 N W 2d 149-154 (1959).

Descriptors: Judicial decisions, *Wisconsin, *Dams, *Water table, Moisture content, *Damages, Riparian land, Reservoirs, Downstream, Flooding mosquitoes.

The Supreme Court of Wisconsin affirmed the lower court's decision that the power company was liable for damages to the plaintiff's land caused by the raising of the water table through the operation of a dam. Testimony of laymen who had been familiar with the condition of the property for many years was sufficient to support a finding that the water table had been raised by the defendant's dam and pool. The amount of damages awarded by the trial court could not be changed by the appellate court. The plaintiffs' only choice of getting more damages would be through a new trial, and they did not ask for a new trial. (Watson-Fla)
W69-01950

WISEMAN V TOMRICH CONSTRUCTION CO (ACTION FOR DAMAGES FROM WRONGFUL DIVERSION OF SURFACE WATERS THROUGH STORM DRAIN).

250 N C 521, 109 S E 2d 248-253 (1959).

Descriptors: *North Carolina, Judicial decisions, *Diversion, Natural flow doctrine, Conduits, *Surface waters, Cities, Road construction, Road design, Roads, *Storm drains, Surface runoff, Damages, Abatement, Drainage systems, Pipes.

Defendant developed a subdivision on land adjoining the plaintiffs'. One of the storm drains from a street in the subdivision wrongfully diverted the natural flow of surface water onto the plaintiffs' land causing damage. The trial court awarded the plaintiff's damages and the appellate court affirmed. The court stated that because the construction company had built houses, sold lots, and dedicated streets to public use the rights of individual homeowners and the public had intervened to such an extent that the remedy of abatement was not available to the plaintiffs. The court also stated the development of the subdivision including the installation of the storm drain constituted a single wrongful act creating a permanent condition. The acceptance by the city of the street did not constitute a wrongful act, and the plaintiffs' only action available was against the construction company. The fact that the subdivision was developed under the supervision and in accordance with the requirements of the city did not effect the liability. (Watson-Fla)
W69-01953

NANTAHALA POWER AND LIGHT CO. V HORTON (CONDEMNATION VALUE OF RESERVED WATER RIGHTS).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01954

AETNA INSURANCE CO. V WALKER (MEANING OF SURFACE WATERS).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01955

LETTERMAN V ENGLISH MICA CO. (FLOODING ABOVE DAM).

249 N C 6769, 107 S E 2d 753-757 (1959).

Descriptors: *North Carolina, *Flood damage, Legal aspects, Floods, *Dams, Watercourses, Backwater, Soils, *Operation and maintenance, Sediment control, River bed, Mining, Mine wastes, Mine drainage, Ponds, Easements, Judicial decisions, Silting beds.

Identifiers: Toe River, Still water.

Plaintiff owned land fronting on the North Toe River about one-half mile upstream from defendant's dam. Drainage to plaintiff's land and roadways allegedly resulted when dirt dumped into the river in the course of upstream mining operations flowed downstream to the still water of the dam, raised the bed of the stream, and caused water to back onto plaintiff's property. Plaintiff grounded his cause of action in trespass and negligence, joining the upstream mine owner and the downstream dam owner. Defendant dam owner's demurser was sustained and plaintiff appealed. This court affirmed. The proprietor of a dam, though not an insurer of the safety thereof, is required to exercise ordinary care in maintenance and operation so as to avoid injury to others occasioned by causes reasonably to be anticipated and guarded against. However, Plaintiff failed to allege sufficient facts to show that the injuries sustained were directly and proximately caused by any act or omission of the defendant. (Bozarth-Fla)
W69-01956

CORRINGTON V KALICAK (LIABILITY FOR CAUSING FLOOD BY OBSTRUCTING A STREAM).

319 S W 2d 888-895 (Ct App Mo 1959).

Descriptors: *Missouri, Judicial decisions, Legal aspects, Streams, *Obstruction to flow, Flooding, *Flood damage, Flash floods, Cities, Bridges, *Excessive precipitation.

Plaintiffs brought suit for damages allegedly caused by a city and a company with which it contracted to build a bridge. In connection with this project, the company had erected scaffolding in the watercourse over which the bridge was to be built. During a heavy rain, logs and debris collected against the scaffolding, causing the stream to overflow and damage plaintiffs' property. On appeal, the St. Louis Court of Appeals held that the damage was caused by the obstruction and not by an Act of God. The court held that the fact that the bridge's construction was a public work would not excuse a trespass committed in the course of the work. This was misfeasance within the course of the city's powers, and therefore it could be held liable in an action for trespass for direct injury, regardless of whether it was intentional or negligent injury. (Williams-Fla)
W69-01958

DESIGN AND OPERATION OF LOW-HEAD SELF-PRIMING SIPHONS.

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01964

NAVIGABLE WATERWAY BETWEEN DEMOPOLIS AND TENNESSEE RIVER AND FLOOD CONTROL PROJECTS ON TRIBUTARY STREAMS OF TOMBIGBEE RIVER.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01966

WATERSHED CONSERVANCY DISTRICTS.

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01969

ERECTION OF DAMS FOR MILLS, GINS OR FACTORIES.

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01970

WELLS, CISTERNS: CARE OF.

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01972

ALLIANCE FOR CONSERVATION OF NATURAL RESOURCES IN PINELLAS COUNTY V FUREN (APPEALING DECISION OF NAVIGATION AUTHORITY ALLOWING FILL OF PORTION OF BAY).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01990

ANDERSON V U S (CLAIM FOR DAMAGES TO FARM LANDS ALLEGEDLY CAUSED BY ESTABLISHMENT OF WILDLIFE REFUGES).

174 F Supp 945-949 (Ct cl 1959) 5 p.

Descriptors: Judicial decisions, *Federal government, Damages, *Flood damage, Administrative agencies, Wildlife management, Rain, Migratory birds, Topography, Snow, *Natural flow doctrine, Drainage, Runoff, Watersheds (Basins), *North Dakota.

This was an action by owners and farm operators of land involved for damages for losses from flooding which they said was the result of activities of the Fish and Wildlife Service. The service obtained easements and flooded some of the low areas adjacent to the land in question for migratory wildlife refuges. The court stated that one could not lawfully divert water from its natural watershed or by artificial structures cause water to flow in another direction or over lands on which it would not otherwise have gone if to do so would deprive a landowner of the use or fruits of his property. However, the court added that it was necessary to prove that any damage suffered was the direct result of the activities complained of and there is no liability for damages caused by flooding which would have occurred regardless. The court held that the evidence presented established that the flooding of the land was caused by adverse weather conditions, topography of the area, and inadequate outlets for the lake rather than as a result of the activities of the Fish and Wildlife Service. (Watson-Fla)
W69-01993

JONES V UNITED STATES (RUNOFF DAMAGE).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01994

ATTORAM REALTY CORP V TOWN AND COUNTRY BUILDERS, INC (DAMAGE FROM DISCHARGING SURFACE WATERS).

8 App Div 2d 936, 109 NYS 2d 499-501 (1959).

Descriptors: *New York, Judicial decisions, Appeals, *Drainage, Gutters, Rain water, *Surface runoff, Precipitation excess, Discharge, *Damages, Erosion, Gullies.

Town and Country Builders, appellants, contest a judgment (1) enjoining them from collecting surface waters on their land and discharging such waters onto respondent's land; and (2) awarding respondent money damages. Appellants, in connection with developing their land, built an 18-inch drain and two 21-inch drains to drain excess rain

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water from their land. Respondent claimed that the increased flow caused by these drains resulted in forming gullies on its property. The judgment was reversed, without costs, to ascertain the damage to respondent's land from the difference in the value of the land before and after the installation of the drains, and to provide injunctive relief if the damages awarded are not paid within a reasonable time. The court found that a mandatory injunction would be oppressive. The measure of damages was changed, because the lower court's finding that the gullies were caused solely by the drains was against the weight of the evidence. (Childs-Fla)
W69-01995

GAGNER V CARLSON (RIGHTS APPURTE-NANT TO FLOWAGE EASEMENT).
150 A 2d 302-308 (1959) 146 Conn 288.

Descriptors: Judicial decisions, *Connecticut, *Easements, Ponds, Beds, Recreation, Dams, Flooding.

A portion of plaintiff's land which abutted a large pond was subject to an easement which allowed defendant to raise the height of a dam on plaintiff's property and to flood the surrounding land. Defendant obtained an injunction against interference by the plaintiff with his use and enjoyment of the pond for recreation and also against interference with his entrance on plaintiff's property to repair a break in the bank of the pond. Defendant's right to enter plaintiff's land for the repairs arises by implication from the grant of the easement because it is necessary for the full enjoyment of the easement, even though the break occurred on land not subject to the easement. The easement was acquired by grant and not by prescription and contains no language limiting its purpose. Therefore it is broad enough to permit the defendant to make any reasonable use of the land to which the easement is appurtenant including recreation. (Molica-Fla)
W69-01997

CROLEY V DE WITT (OBSTRUCTION OF DRAIN).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01999

4B. Groundwater Management

FIELD OBSERVATIONS COMPARED WITH DUPUIT-FORCHHEIMER THEORY FOR MOUND HEIGHTS UNDER A RECHARGE BASIN,
Agricultural Research Service, Fresno, Calif.
W. C. Bianchi, and E. E. Haskell, Jr.
Water Resources Res, Vol 4, No 5, pp 1049-1057, Oct 1968. 9 p, 4 fig, 5 tab, 16 ref.

Descriptors: Hydrographs, *Pit recharge, *Water level fluctuations, *Mathematical studies, *Dupuit-Forchheimer theory, Infiltration, Observation wells, Water levels.
Identifiers: Groundwater mounds.

A theoretical analysis, using the Dupuit-Forchheimer assumptions, of rising and falling hydrographs of the groundwater mound beneath the center of square and circular recharge basins, is presented. The analysis was field tested using 2-acre square ponds in Panache clayloam. Observation wells were arrayed radially along the perpendicular bisectors of the sides of the ponds. The analysis was found to be generally acceptable. Discrepancies between calculated and observed values are due to imprecision in measuring or estimating physical parameters. (Knapp-USGS)
W69-01655

USE OF STORM RUNOFF FOR ARTIFICIAL RECHARGE,
J. E. Berend, M. Rebhun, and Y. Kahana.
Am Soc Agric Engrs-Trans, Vol 10, No 5, pp 678-84, 1967.

Descriptors: *Storm runoff, *Water quality, *Instrumentation.
Identifiers: Surface permeability, Israel.

Utilization of flood water both as source of additional supply and as means of introducing low-salinity water into water supply system in Israel; studies were carried out on development of adequate research methods and of suitable instrumentation, and in such manner as to make them also useful in planning reclamation of sewage effluents; studies of quality of waters and their response to treatment, infiltration capacity of spreading grounds and analysis of infiltration phenomena, and process of clogging, its prevention and corrective measures are discussed.
W69-01864

EXPERIMENTS IN WATER SPREADING AT NEWARK, DELAWARE.
D. H. Boggess, and D. R. Rima.
U S Geol Surv Water Supply Pap 1594-B.

Descriptors: *Storm runoff, *Groundwater recharge.
Identifiers: Surface permeability, Newark (Del).

Results are given of further experiments at Newark, Del., on the possibility of using excess storm run-off to recharge ground water (see Wat. Pollut. Abstr., 1961, 34, Abstr. No. 761). Although nearly 500,000 gal of water were spread in an infiltration ditch near the municipal well field and allowed to seep into the sub-surface, there was no indication that any appreciable amount of water reached the producing aquifer. Instead, a perched zone of saturation was created by the presence of an impermeable or slightly permeable bed above the water table. This layer barred the downward movement of water so effectively that in less than one day the apex of the perched zone rose about 10 ft to the level of the bottom of the infiltration ditch, and as more water was added the mound of saturation spread laterally. From these experiments it was concluded that the principal aquifer at Newark would not be benefited by spreading water in shallow infiltration ditches or basins, although the absorptive capacity of the unsaturated materials which occur at shallow depth is sufficient to permit the disposal of large volumes of storm water. However, the well field might be recharged by other methods; one possible solution would be a shallow basin to store excess storm water both of the land surface and in the permeable beds at shallow depth, and within this basin recharge shafts could be constructed to expose the top of the producing aquifer and allow water from the surface and from the sand and gravel bed to infiltrate through the shaft and into the aquifer below.
W69-01865

DISPOSAL OF STORM WATER BY GROUND WATER RECHARGE,
G. Congguy.
Calif Dept Water Resources-Biennial Conf on Ground Water Recharge and Ground Water Basin Management-Proc. 1963. 10 p.

Descriptors: *Storm runoff, *Groundwater recharge, *Highways.
Identifiers: *Capacity.

Utilization of excavated pit type of recharge basin for collection and disposal of storm water from roadways in various areas of San Joaquin Valley, Calif.; basins vary in size from 1-6 acres, depending on storage requirement, and are located close to roadway; usually, basins are used as material sites for roadway embankment material.
W69-01877

SARGENT V GAGNE (EASEMENT TO USE OF WATER SUPPLY ON THE LAND OF ANOTHER).

147 A 2d 892-901 (Vt 1958).

Descriptors: Judicial decisions, *Vermont, *Springs, Aqueducts, Pipelines, *Easements, *Water supply.

Both parties claimed ownership of a spring on the defendant's property. The court established that the spring belonged to the plaintiff through a deed to his predecessors many years previous. The defendants were enjoined from interfering with the plaintiffs' right to take water from the spring and from interfering with plaintiffs' repair and maintenance of a pipeline from the spring. The court held that the exception of the spring in the grant from the common grantor to the defendants' predecessor in title had the legal effect of carving out and separating the spring from the defendants' farm. The fact that the deed from the defendants' immediate grantors failed to mention such exception did not enlarge the defendants' right to the spring. Defendants also had the burden of proving any abandonment of the easement, which they failed to satisfy. (Watson-Fla)
W69-01939

**4C. Effects on Water
OF Man's Non-Water
Activities****EVALUATION OF THE EFFECT OF MINING THE IRON ORE DEPOSITS OF THE KURSK MAGNETIC ANOMALY ON THE FLOW REGIME OF THE OSKOLETS RIVER,**
B. M. Dobroumov, I. N. Obraztsov, and B. S. Ustyuzhanin.

Translation from Trudy Gos Gidrol Inst No. 139, 1967, pp 206-223. Soviet Hydrol, Selec Pap No 1, pp 42-56, 1967. 15 p, 5 fig, 8 tab, 2 ref.

Descriptors: *Mine water, *River flow, *Surface-groundwater relationships, *Mine drainage, *Hydrologic budget, Water balance, Infiltration, Induced infiltration, Dewatering, Diversion structures, Waste water disposal.
Identifiers: *Water management measures, USSR, Oskolets River Basin, Chern' River Basin.

The effect on river flow of large-scale pumping for water control in deep iron mines in the USSR is described. In the area of the Mikhaylov iron mine in the Chern' River Basin, mined since 1960, the 1964 water-level depression reached 60m, the cone of depression had a radius of 18 km, and discharge by pumping was 180 liters per sec. Near the Lebedi mine, the largest in the Oskolets River Basin, a cone of depression 10 km in radius and 80 m deep was formed by pumping over 1,600 liters per sec, or about 80% of the normal flow of the river. The cone extends under the river and induces recharge, increasing the need for pumping. A detailed hydrologic budget was computed for the Oskolets River and is presented in tables, graphs, and profiles. The main factors in changing the river's regime are discharge of mine drainage water into the river, diversion of water from the river for municipal and industrial use, decrease in natural groundwater discharge, and induced recharge into the mine-drainage cone of depression. (Knapp-USGS)
W69-01629

MAGNITUDE AND FREQUENCY OF FLOODS IN SUBURBAN AREAS,
R. W. Carter.
U S Geol Surv Prof Pap 424-B, B.9-B.11, 1961.

Descriptors: *Drainage systems, *Hydrographs, Land use, *Infiltration, Peak discharge, *Floods.
Identifiers: *Suburban drainage, Washington, D. C., *Surface permeability.

Suburban development changes two of the basic elements that determine the magnitude and timing of the volume and peak of the flood hydrograph, namely the average infiltration rate (which is decreased because roofs and streets are impervious), and the lag time between rainfall excess and

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the flood hydrograph (which is decreased because of storm sewers and improvements to the principal stream channels). The net effect of these changes has been evaluated in the vicinity of Washington, D. C. After analysing the data statistically, it is concluded that for drainage basins larger than 4 square miles in the Washington area the maximum effect of complete suburban development on flood peaks of any recurrence interval is expressed by the ratio flood discharge (suburban): flood discharge (undeveloped)=1.8.

W69-01663

POLLUTION PREVENTION IN NORTHERN IRELAND,

For primary bibliographic entry see Field 05B.

For abstract, see .

W69-01818

SEDIMENT IN SMALL RESERVOIRS DUE TO URBANIZATION,

H. P. Guy, and G. E. Ferguson.

ASCE Proc, J of Hydr Div, Vol 88, No HY2, 1962.

Descriptors: *Land use, *Sedimentation.

Identifiers: *Urban drainage.

Increasing urban development may cause severe silting in small reservoirs downstream from such developments. A typical example is that of lake Barcroft, near Washington, D. C., where 19 acre-ft or 25,000 tons of sediment have been deposited for each square mile of completed residential construction. Factors affecting sedimentation in urbanized areas are listed; these are similar to those occurring under rural conditions, but are more difficult to evaluate. Material deposited in a reservoir after urban construction will probably be coarser than that associated with rural conditions.

W69-01820

THE POLLUTION OF RUN-OFF FROM URBAN HOUSING ESTATES,

H. E. Kurzweil.

Gesundheits-Ing, Vol 85, 178, 1964.

Descriptors: Runoff, Rainfall-runoff relationships, *Rainfall intensity, *Water quality, *Biochemical oxygen demand, *Dissolved oxygen, *Water pollution, Sewage treatment, *Storm runoff.

Identifiers: *Urban drainage, *Storm sewers.

Based on studies of rainfall and run-off in urban areas, during storms of varying intensity, results are given on the changes in the quality of water from roofs and paved areas, including data on 5-day B.O.D., dissolved oxygen, and organic substances. The discharge of this polluted water to the stormwater sewer or sewerage system is discussed and the author recommends preliminary treatment of this run-off to reduce pollution.

W69-01831

ENVIRONMENTAL EFFECTS OF HIGHWAYS,

M. E. Scheidt.

ASCE Proc, J Sanit Eng, Div, Vol 93, No SA 5, Pap No 5509, pp 17-25, 1967.

Descriptors: *Highways, *Water pollution, Construction, *Surface runoff.

The author discusses the various polluting effects of highways on the natural environment. The greatest source of pollution is erosion during construction of the highway, which can cause considerable damage downstream, and measures to control such erosion are required during the construction of federal and federal-aided highways. Other sources of pollution are chemicals used to melt ice and snow and to control roadside vegetation, spills from vehicles involved in accidents, and run-off from paved areas.

W69-01854

ECONOMIC STUDY OF URBAN AND HIGHWAY DRAINAGE SYSTEMS,

J. W. Knapp.

Johns Hopkins Univ-Dept Sanit Eng and Water Resources-Tech Report 2, June 1965. 175 pp.

Descriptors: *Drainage systems, Design, *Highways, *Runoff, *Flood control, *Model studies, *Intakes.

Identifiers: *Urban drainage.

Characteristics of flood losses are investigated; information collected on cost of drainage facilities and damages in urban areas is analyzed; for highway drainage, interruption of traffic flow is interpreted as major flood damage; mathematical models are developed for solution of specific drainage problems; stimulation is used to describe random effects of runoff and traffic in model for selecting pumping facilities to remove storm water at highway underpass; two models for finding optimum spacing of inlets are developed and solved.

W69-01887

DETERMINATION OF RUN-OFF COEFFICIENTS,

For primary bibliographic entry see Field 02E.

For abstract, see .

W69-01889

LOCATION OF STORM DRAINAGE COSTS,

For primary bibliographic entry see Field 06C.

For abstract, see .

W69-01891

SUBURB MEETS URBANIZATION HEAD-ON,

Ayers, Lewis, Norris, and May, Ann Arbor, Mich.

R. J. Smit, R. R. Robinson, and T. W. Swift.

Water Wastes Eng, Vol 4, No 11, pp 47-9, Nov 1967.

Descriptors: *Design, *Sewers, *Construction costs, Grants.

Identifiers: *Urban drainage, Interceptor sewers.

The doubling of student enrollment since World War II at the University of Michigan has exerted considerable pressure on living facilities in the three surrounding areas, East Lansing, Lansing and Meridian Township. The existing sewage treatment plant was overloaded. The three areas negotiated to divide the costs of a new sewage treatment plant, new on-campus interceptors and new sewer main construction. Design of the main sewer system is discussed. Obstacles in planning and financing of the undertaking are described. Lateral sewers in 12 districts were financed by bonds totalling \$1.84 million. In addition some financing was available through federal grants. The total construction costs were about \$3.8 million. It is hoped that the lessons learned by this township government in facing the challenge of growth will be useful to other suburban communities with similar problems.

W69-01895

STUDIES OF SEVERE RAINSTORMS IN ILLINOIS,

For primary bibliographic entry see Field 02E.

For abstract, see .

W69-01896

HYDROLOGIC EFFECTS OF URBAN GROWTH—SOME CHARACTERISTICS OF URBAN RUN-OFF,

A. O. Waananen.

A. S. Geol Surv Prof Pap 424-C, C.353-C.356, 1961.

Descriptors: Land use, Runoff, *Storm runoff.

Identifiers: *Urban drainage, *Urban hydrology.

The author discusses the effects of urban development on flow in streams. The changes in run-off characteristics following urban growth are illus-

trated graphically. Peak run-off from developed areas may be 3-4 times that from upstream or adjacent natural areas. In urban areas, a substantial part of the run-off occurs during a short period following a storm and the rapid discharge into receiving channels and streams reduces the opportunity for evaporation and transpiration as well as infiltration and percolation.

W69-01903

PRELIMINARY STUDY OF EFFECT OF URBANIZATION ON FLOODS IN JACKSON, MISSISSIPPI,

K. V. Wilson.

U S Geol Survey-Prof Paper 575-D, pp D259-61, 1967.

Descriptors: Land use, *Flood forecasting.

Identifiers: *Urban hydrology, *Urban drainage, Surface permeability.

Comparison of flood-frequency curves for three streams near Jackson, Miss., based on annual maximum floods for period 1953 to 1966, and for another stream for shorter period, indicates that mean annual flood for totally urbanized basin is about 4 1/2 times that of similar rural stream; it further indicates that 50-yr flood for such urbanized basin is about three times that of rural stream.

W69-01907

WATERFRONT RENEWAL IN METROPOLITAN AREAS,

Donald F. Wood.

ASCE Proc, J Urban Planning Devel Div, Vol 93, No UP4, pp 199-213, Dec 1967.

Descriptors: *Drainage systems, Flood control, Water pollution control, Planning, Recreational facilities, Storm runoff, Land use.

Identifiers: *Urban drainage.

Many of our urban waterfronts are blighted because of age and conditions unique to their location, such as vulnerability to flooding or surface water pollution. A range of actions, from simple clean-up to full scale clearance and relocation, can be used to fight waterfront deterioration. Metropolitan and basinwide approaches are needed because frequently an individual city cannot control what happens upstream or on the other side of a river. Federal urban renewal programs help to reduce the local cost. In a metropolitan waterfront renewal program the engineer must determine the condition of all shore line and the costs of repairing or replacing it. New uses can be found for old waterfront structures. Altering the amount of shore line; providing open space and access; reducing flood and storm damage; and renewing for navigational, waterfront industrial and recreational uses are also discussed. Providing adequate storm drainage for the renewal area is an important part of an improvement plan. This drainage system could be designed to improve drainage in a larger area than just the renewal project and the area benefiting can share costs. Aspects to be considered in planning include increased runoff due to development upstream, old dams, dredging of channels and winds. Some solutions are offered.

W69-01909

RUSKIN BROS, INC V STATE (DEBRIS BLOCKAGE OF CATCHBASIN),

8 App Div 2d 895, 187 N Y S 2d 51-53 (1959).

Descriptors: *New York, Judicial decisions, Riparian rights, *Screens, Natural streams, Upstream, *Watersheds (Basins), Culverts, *Obstruction to flow.

The State built a highway passing over a culvert carrying a natural stream which flowed through plaintiff's land. The State installed a screen at the

Identification of Pollutants—Group 5A

mouth of the culvert to prevent its blockage by debris coming from upstream. Plaintiff built a catchbasin on his land to lower the level of the stream to permit a covering over a part of his land. Subsequently, the State removed the screen and the debris which passed into the catchbasin caused it to become blocked and as a result plaintiff's cellar was flooded. The State is not liable for merely allowing the stream to flow unimpeded. The accumulation of water was caused by the catchbasin. An upper riparian owner is not chargeable with negligence in allowing debris to flow through his land from above which may cause damage below provided he does not increase the debris in the stream. (Molica-Fla)

W69-01996

4D. Watershed Protection**TIME IN URBAN HYDROLOGY,**

G. E. Willeke.

ASCE Proc, J Hydraulics Div, Vol 92, No HY 1, paper 4615, pp 29-31, Jan 1966.

Descriptors: *Rainfall-runoff relationships, Rainfall intensity, Watersheds, *Hydrographs.
Identifiers: *Urban hydrology.

Analysis of lag time (defined as time between centroids of effective precipitation and runoff) from nine small urban watersheds shows that lag time variability is small and that lag time is not correlated with storm intensity; effective precipitation can be routed through storage by Muskingum method to accurately reproduce observed runoff hydrograph; effective precipitation is separated from total precipitation by phi-index; precipitation loss on watershed is closely represented by linear relationship between total storm precipitation and total storm runoff.

W69-01906

05. WATER QUALITY MANAGEMENT AND PROTECTION**5A. Identification OF Pollutants****LICKING RIVER AND TRIBUTARIES, OHIO (FLOOD CONTROL AND ALLIED PURPOSES).**

Corps of Engineers, Washington, D. C.

U S 90th Congr, 2d Sess, House Doc No 337, 182 p, 1968. 1 map, 21 tab, 1 append, 1 attach.

Descriptors: *Multiple-purpose projects, *Flood control, *Recreation, *Channel improvements, Dams, Ohio, Cost-benefit ratio, Water values.
Identifiers: Licking River, Newark (Ohio), Economic development.

In determining the advisability of providing improvements for the assessed water resources needs within the Licking River Basin, Ohio, several reservoirs were considered for both multiple and single purpose development. Only Utica Reservoir on North Fork of Licking River was found to be economically justifiable. The Utica project would provide for the water supply and water quality control needs of the basin until the year 2020, would provide recreation opportunities to some 450,000 visitors annually, and would provide reductions of flood crests along North Fork. To further alleviate the severe and frequent flooding at Newark, several local protection schemes were investigated for three independent areas. Economically feasible projects were developed for the protection of a rapidly expanding residential area along Log Pond Run, for improving the interior drainage facilities behind the existing Federal levee, and for improvement of the North Fork channel. Acting as a system, Utica Reservoir and the improvement of the North Fork channel would prevent 91% of the

average annual damages along North Fork in Newark. The diversion plan would reduce average annual damages along Log Pond Run by 73%. Improvement of the interior drainage facilities would eliminate a serious health hazard and would prevent flood damages due to insufficient pumping capacity. The survey report concludes that Utica Reservoir, the Log Pond Run diversion project, improvement of interior drainage facilities of the completed local protection project and improvement of 5,900 feet of the channel of North Fork of Licking River should be added as units in the plan of water resources development for the Licking River Basin to supplement existing projects of the Corps of Engineers.

W69-01647

A HORN FORETELLS SEWER OVERFLOWS.

Amer City, p 58, May, 1967.

Descriptors: *Instrumentation, *Overflow, *Sewers.

A description of an electronic device in use at five lift stations in McPherson, Kan., which warns if sewage levels rise too high is given. When sewage rises too high it contacts an electrode, a light flashes and a horn blows in police headquarters. Device saves about 100 man-hours of work/month. A sketch and wiring diagram are given.

W69-01657

TV SEWER INSPECTION,

Robert H. Brindley.

Amer City, Vol 79, pp 87-89, Jan 1964.

Descriptors: *Equipment, Sewers.

Identifiers: *Sewer inspection.

The television sewer inspection equipment of the Hartford, Conn., Metropolitan District is described in the article. Inspections have proven effective in locating house laterals, finding sewer obstructions, and determining condition of sewers. A crew consists of television operator, forward winch man, and cable guide man. The camera can best be pulled through the sewer by a hand winch that has reduction gears with a pulley and brace mounted in the manhole. A direct-wire intercom with a talk-back speaker provides communication and permits the winch man to keep both hands free. Sewers needing cleaning or flowing over one-third full are not conducive to TV inspection. Difficulties in the use of the equipment have been resolved: camera skids have been modified to prevent fouling of lines; a more powerful camera light has been installed for use in small sewers; work has been rescheduled when radio frequency interference occurred; and fog has been moved through the sewers by a portable blower forcing air into the manhole.

W69-01661

LARGEST SEWER PHOTO INSPECTION,

C. E. Cannon.

Am City, Vol 80, No 1, pp 98-9, Jan 1965.

Descriptors: *Sewers, *Equipment.

Identifiers: *Sewer inspection, *Storm sewers.

Extensive underground photographic survey, carried out at Anchorage, Alaska, to assess damages caused by earthquake, covered 600,000 ft of 8- to 21-in. sanitary and storm sewers; Inspectoline camera equipment and Wayne 3-D Pipeline Survey cameras were employed by two inspection groups; methods followed to determine condition of pipe lines.

W69-01662

MONITORING STORM-WATER OVERFLOWS,

A. D. Caster.

J Water Poll Control Fed, Vol 37, pp 1275-1280, 1965.

Descriptors: *Overflow, *Water pollution control, Instrumentation.

Identifiers: *Interceptor sewers, Cincinnati (Ohio).

A description is given of the system installed at Cincinnati, Ohio, to detect when overflows occur from the sewers as a result of clogging of the interceptors with solid materials during normal dry-weather flow. A signalling device is fitted at each interceptor and the signal is transmitted to the telephone exchange. It is hoped by this means to reduce pollution of the various creeks within the metropolitan area.

W69-01664

NEW INSTRUMENT CAN MEASURE SEWAGE FLOW,

A. E. Cruchley.

Munic Eng, Vol 136, pp 814-815, 1959.

Descriptors: *Flow measurement, Surface drainage, *Sewers, *Flowmeters.

An illustrated description is given of a new instrument, developed by the Road Research Laboratory during investigations on surface water drainage, for recording flow in sewers. The device records variations with time in the rate of sewage flow and the periods of time during which the flow is in excess of certain values selected for particular study. The instrument is composed of a movement recorder and a time totalizer, the latter consisting of a time base and multiple-contact switch-unit within the movement-recorder and a separate box containing a rectifier and a battery of counters.

W69-01665

TEMPORARY FLOW MEASUREMENT IN SEWERS AND DRAINS,

For primary bibliographic entry see Field 07B.

For abstract, see .

W69-01667

A FIELD METHOD OF MEASURING AND RECORDING FLOW IN SEWERS,

For primary bibliographic entry see Field 07B.

For abstract, see .

W69-01668

SEWAGE SAMPLING,

L. B. Escritt.

Water and Waste Treatment J, Vol 8, No 10, Nov-Dec 1961.

Descriptors: *Sampling, Instrumentation, *Sewage treatment.

Discussion on the value of sewage sampling points out the care that should be taken whether samples are collected by hand or machine and describes methods used in hand sampling, automatic sampling, and importance of weighted samples. A simple weighted automatic sampler of the type used by the London County Council at outfall works is described in detail. This sampler has no moving parts except a pump and collects 43 samples per day totaling 4 gallons at high flows and 12 samples per day, about 1 gallon of sample, during low flows in proportion to the flow.

W69-01669

METHODS AND EQUIPMENT FOR THE MEASUREMENT OF SEWAGE FLOW,

H. Fathmann.

Wasser Luft Betrieb, Vol 10, pp 668-673, 1966.

Descriptors: *Flow measurement, *Weirs, Instrumentation, *Sewers.

Identifiers: *Calculations.

Quantitative measurements within a definite given time are often required for experimental purposes and operational research. For this purpose tank measurements are employed, using floats and mea-

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Group 5A—Identification of Pollutants

suring weirs. Stationary calculations on volume of sewage are carried out by measurements in pressure pipe lines according to the Venturi principle or as inductive measurements for the rate of flow. W69-01670

FLOW MEASUREMENT TECHNIQUES,

G. D. Healy, Jr.

Instruments and Control Systems, Vol 38, No 3, pp 111-15, March 1965.

Descriptors: *Flow measurement, *Flowmeters, Instrumentation, *Sewers.

Review of flow measurement techniques commonly used for water and sewage, volumetric meters, timed volume flow, variable headmeters, pilot tube, orifices, venturi, nozzles and open channel techniques. W69-01672

A FIELD METHOD OF MEASURING AND RECORDING FLOW IN SEWERS,

C. Thorne Johnston, and Warren Ellis.

Pub Works, Vol 94, No 6, p 124, 1963.

Descriptors: *Flow measurement, *Sewers, Instrumentation, *Flowmeter.

Article describes the use of a snap-ring tube jacked into a sewer pipe in which a bubbler-tube using nitrogen gas transfers flow depth to a recorder. This method requires that a depth-discharge curve be computed for a reach of sewer. Advantage is in cost and elimination of problems of location and operation of devices such as flumes. W69-01674

DISCHARGES FROM SEPARATE STORM SEWERS AND COMBINED SEWERS,

W. J. Benzie, and R. J. Courchaine.

Water Poll Control Fed J, Vol 38, No 3, p 410, March 1966.

Descriptors: Discharge (Water), *Coliforms, *Chemical analysis, Runoff.
Identifiers: *Combined sewers, *Storm sewers, *Bacteriological sampling.

Discharges from a separate storm sewer system showed mean median bacterial counts per 100 ml of 12×10^6 , 0.82×10^6 , and 1.4×10^6 for total coliforms, fecal coliforms, and fecal streptococci, respectively. Corresponding figures for discharge from a combined system were 94×10^6 , 2.7×10^6 , and 5.8×10^6 . The ratios of fecal coliforms to fecal streptococci in the combined and separate systems were 4.7 and 0.6, respectively, indicating that the bacteria in the combined system are primarily of human origin, whereas those in the separate system are derived from other warm-blooded animals. Phosphates and nitrates in combined system discharges were about 3 to 4 times greater than contents in discharges from separate systems. W69-01796

DESCRIPTION OF A COMMUNITY OF MICRO-ORGANISMS IN PURIFIED SEWAGE MIXED WITH RAIN WATER FROM STORM SEWERS,

T. G. N. Dresscher.

Hydrobiologia, Vol 14, 1959.

Descriptors: *Storm runoff, *Sewage effluent, Water pollution, *Chemical analysis.
Identifiers: *Bacteriological sampling, Amsterdam (Holland).

The author gives details of the community of micro-organisms isolated during the period 1953-1958 from a canal to which are discharged storm water and the effluent from the activated sludge plant serving the western part of Amsterdam. Sampling procedures and biological investigations are

described and a comprehensive list of organisms isolated during this period is given. The determination of micro-biocenosis, based on the number of micro-organisms present, is discussed. Results of bacteriological and chemical investigations are also given. The Eijkman test carried out at 45 degrees C and the determination of faecal streptococci showed a decrease in faecal pollution from 1953 to 1957, but pollution increased again in 1958. The average chemical results also showed that pollution was least in 1956 and 1957, and this coincided with a reduction in the numbers of Euglenophyceae and some other organisms. W69-01809

OPERATING CHARACTERISTICS OF BACTERIAL WATER QUALITY STANDARDS,

Walter Reed Army Inst of Research, Washington, D. C.

D. W. Duttweiler.
Am Water Works Assoc J, Vol 58, No 6, pp 742-50, June 1966.

Descriptors: Design, *Water quality, *Bioindicators, *Coliforms.

Identifiers: *Bacteriological sampling, *Calculations.

Operating characteristics provide a basis for rational design of water quality surveillance programs. In this paper operating characteristic curves of the USPHS bacteriologic quality standards are derived for both the membrane filter method and the most probable number method. These curves indicate the probability that water of a certain coliform bacteria density will be acceptable. The importance of volume and number of monthly samples in determining the risks of unknowingly accepting waters having high coliform densities is discussed. Under present USPHS standards, the probability of rejecting water having a coliform density of 1 per 100 ml. is relatively constant and less than 0.01 for all membrane filter method and most probable number method day-to-day samples. It is suggested that greatly improved drinking water quality control be obtained by examining a minimum of 8 monthly 200-ml. samples by the membrane filter method for continuous surveillance. Operating characteristic curves are shown for monthly control periods for both the membrane filter method and the most probable number method. W69-01812

COLIFORM AFTERGROWTHS IN CHLORINATED STORM OVERFLOWS,

R. Eliassen.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA2, paper 5913, pp 371-80, April 1968.

Descriptors: *Coliforms, *Storm runoff, *Overflow, *Chlorination, Estuaries.

Identifiers: *Combined sewers, Bacteriological sampling, Dilution.

Laboratory tests were conducted on possible bacteriological effects of combined sewer storm overflows into tidal estuary; overflow mixture was diluted with 3 to 25 volumes of estuarine waters to represent dilutions expected under average storm conditions; bacterial growths were observed in raw overflow and at various dilutions, using 3-liter flasks at 68 F, with incubation periods up to 120 hr; most probable number values of coliforms were determined after fixed time intervals. W69-01813

THE FLOW IN A STREAM AS A MEASURE OF THE DEGREE OF DILUTION OF STORM-WATER DISCHARGES,

R. Gaul.
Gesundheits-Ing, Vol 73, 404, 1952.

Descriptors: *Storm runoff, Flow measurement, *Waste dilution.

Identifiers: *Combined sewers.

A method is described for calculating the discharge of storm water from combined sewerage systems in relation to the flow of the receiving stream. W69-01817

RIVER-WATER QUALITY CRITERIA IN RELATION TO WATERWORKS REQUIREMENTS,

For primary bibliographic entry see Field 05G.
For abstract, see .
W69-01825

ANALYSIS OF DISSOLVED OXYGEN DISTRIBUTION IN EAST RIVER,

D. J. O'Connor.
Water Poll Control Fed J, Vol 38, No 11, pp 1813-30, Nov 1966.

Descriptors: *Water quality, *Storm runoff, *Overflow, *Dissolved oxygen, Biochemical oxygen demand.

Identifiers: *Calculations, East River (NY).

Analysis of water quality in East River, New York, by mathematical model consisting of linear differential equations produced results agreeing generally with observation of actual conditions; storm overflows and sludge deposits appear to have significant effects; spatial profile of DO is directly related to wastewater discharges and temporal distribution is established primarily by temperature distribution during summer; future work will require more accurate measurements of sludge deposits, storm overflows, nitrogenous, and carbonaceous BOD components, exchange and dispersion coefficients, and other parameters. W69-01842

EVALUATION OF DISPERSED POLLUTIONAL LOADS,

G. W. Reid, and J. Cleveland.
ASCE Environ Eng Conf-Preprint 422, Feb 6-9, 1967. 10 p.

Descriptors: *Storm runoff, *Land use, *Water quality, *Runoff.

Identifiers: *Calculations, *Urban drainage, Tulsa (Okla).

Experimental technique proposed is to determine quality of storm water from individual drainage basins that make up urban Tulsa City-County, Oklahoma, and by using component analysis technique, evaluate effects of land use practices on quality of runoff; stream is sampled twice monthly during dry weather flow, and several times during storm runoff period; 'dry' streams are sampled just during runoff period; it is estimated that at least 1 or possibly 2 yr of data will be needed to make representative estimation of true quality and quantity of runoff; principal components of many variables will be estimated by component analysis technique; knowing principal component regression analysis can be used to determine best model and predictive equation. W69-01848

5B. Sources of Pollution

GROUNDWATER CONTAMINATION AND HYDROCHEMICAL FACIES OF SHALLOW AQUIFERS IN MASSACHUSETTS,

Massachusetts Univ., Amherst, Dep of Geology.

For primary bibliographic entry see Field 02K.
For abstract, see .
W69-01639

ATMOSPHERIC CONTRIBUTIONS TO WATER QUALITY OF STREAMS IN THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE,

U. S. Geological Survey and Sears, Roebuck and Co., Chicago, Illinois, and Dartmouth College, Hanover, New Hampshire.

For primary bibliographic entry see Field 02A.

For abstract, see .

Sources of Pollution—Group 5B

W69-01644

MIGRATION OF POLLUTANTS IN A GLACIAL OUTWASH ENVIRONMENT,
Washington State Univ., Pullman.
James W. Crosby, III, Donald L. Johnstone, and
Charles H. Drake.
Water Resources Res, Vol 4, No 5, pp 1095-1114,
Oct 1968. 20 p, 17 fig, 1 tab, 17 ref.

Descriptors: *Path of pollutants, *Groundwater,
*Soil disposal fields, *Sands, *Gravels, Glacial drift.
Model studies, Washington.
Identifiers: Spokane Valley (Washington).

The movement of pollutants in glacial outwash in the Spokane Valley, Washington, was studied by drilling test holes in a hospital's waste disposal system drainfield and further checked by constructing a sandbox model of a stratified sand and gravel deposit. Dry deposits were found, by study of drilling samples and nuclear well logs, at depths of 20-40 ft below the drain field. Most of the water in the drain field and the model is dispersed laterally in the finest beds by capillary movement and probably returns to the atmosphere by evapotranspiration. The moisture conditions in the drain field and local climate data suggest that recharge by precipitation is very unlikely in the study area. Chemical pollutants were observed to move with moisture fronts, but particulate matter, including bacteria, did not travel more than a few ft. (Knapp-USGS)
W69-01645

INTERCEPTOR SEWERS,
For primary bibliographic entry see Field 08A.
For abstract, see .
W69-01728

SURVEY OF NAJAFGARH DRAIN DOWNSTREAM OF INDUSTRIAL AREA,
K. R. Bulusu, and V. P. Sharma.
Environ Health, India, Vol 8, pp 103-111, 1966. 3 tab.

Descriptors: *Storm runoff, Discharge (Water),
*Dissolved oxygen, *Biochemical oxygen demand,
Water quality, Standards, *Rainfall intensity,
*Water pollution.
Identifiers: *Suspended solids, *Combined sewers,
Jumna River (India).

During the period March-July 1962, the Najafgarh drain, which carries a mixture of industrial waste water and sullage besides storm water, and the stretch of the Jumna River into which it discharges, were surveyed 11 times from 12 stations. Graphs and tables are given showing quantitative data on total and suspended solids, dissolved and absorbed oxygen, BOD, chlorides and sulphates. The quality of the river water at a station near the point of discharge was judged to be satisfactory in relation to the requirements of the Indian Standards Institution and it is concluded that, during the summer, the quality of the water is suitable for use at a downstream water works and by riparian owners, but that heavy rains will cause excess pollution as a result of bottom scouring.
W69-01729

SEWER INFILTRATION.
For primary bibliographic entry see Field 08G.
For abstract, see .
W69-01735

EFFECTS OF INFILTRATION,
David P. Backmeyer.
Water Pollut Control Fed J, Vol 32, No 5, pp 539-540, May 1960.

Descriptors: *Pumping, *Corrosion, *Sewers.
Identifiers: *Sewer infiltration, Florida.

The problems of infiltration of both fresh and salt water in the sewage collection and treatment plants in Florida are briefly discussed. Because of the flatness of the land many more pumping stations are necessary in Florida cities than is usual. This magnifies the overflow problem. Problems include corrosion of treatment facilities by salt and other chemicals in sea water.
W69-01736

DETECTION AND SEALING OF LEAKS IN SEWERS,
B. W. Brunton.
Can Mun Utilities, Vol 101, No 12, pp 22-3, Dec 1963.

Descriptors: *Sewers, *Sealants, Equipment.
Identifiers: *Sewer infiltration.

New chemical grouting method tried in Sudbury, Ont., to repair gaps between joints in sewer system and prevent infiltration consists of TV camera and rejoinder apparatus attached to cable drawn through sewer lines, when leak joint is noticed, rejoinder is drawn to edge of pipe joint, then drawn required distance to have it centered at joint which is then confined and sealed by remote control using chemical grouting material; rejoinder consists of hollow aluminum cylinder slightly smaller in diameter than pipe, encased in rubber jacket which is strapped to cylinder at ends and at center.
W69-01738

PIPE JOINTS LIMIT INFILTRATION,
For primary bibliographic entry see Field 08G.
For abstract, see .
W69-01739

THE INFILTRATION PROBLEM IN SEWAGE COLLECTION SYSTEMS,
Arthur A. DeFraites.
Southwest Water Works J, Vol 44, No 10, Jan 1963.

Descriptors: *Sewers.
Identifiers: *Sewer infiltration.

The author discusses the sewage infiltration problem and gives his views on how near he believes it is to being solved.
W69-01740

EXFILTRATION TESTING OF LARGE SEWERS IN KANSAS CITY, MO.,
J. F. Fladung, and L. W. Weller.
Water and Wastes Eng, Vol 4, No 9, pp 87-9, Sept 1967 and No 10, pp 60-63, Oct 1967.

Descriptors: Sewers, Manholes, Water pollution control.
Identifiers: *Sewer infiltration, *Leak detection,
*Kansas City (Mo.).

Test results discussed are for sewers constructed of reinforced concrete pipe, with manholes included in test sections; exfiltration specification used permits leakage of 200 gal/in. of ID/mi/24 hr; data are presented on several contracts under Kansas City's pollution abatement program; exfiltration test conditions and results are summarized.
W69-01741

AN EVALUATION OF THE PROBLEMS OF SANITARY SEWER SYSTEM DESIGN,
J. C. Geyer, and J. J. Lentz.
J. Water Poll Control Fed, Vol 38, No 7, p 1138, July 1966.

Descriptors: *Sewers, *Design, *Storm runoff, Construction, *Groundwater.
Identifiers: *Sewer infiltration, *Residential sewers.

A study of sewer systems in four communities revealed that flow of domestic wastewater follows indoor water use and undergoes little seasonal change. Per-capita use increases with the economic status of the area. Flows of stormwater and groundwater infiltration often exceed domestic flows considerably where poor sewer construction and illicit connection to the system are prevalent. Stoppages are caused chiefly by roots and accumulated deposits, the latter especially at the upper ends of systems. Bituminous joints are most resistant to root penetration; newer materials have not been evaluated. Other causes of stoppages are slug discharges of grease and mud from construction.
W69-01742

ELIMINATING INFILTRATION OF GROUND WATER INTO SEWERS,
J. Godbehere.
Surv, London, Vol 121, 1962.

Descriptors: *Flow measurement, Sewers, *Sealants, *Groundwater.
Identifiers: *Sewer infiltration.

The author summarizes events which led to the application of Terraseal for controlling infiltration of ground water into sewers in the rural district of Amersham, Bucks. As a result of infiltration the cost of disposing of sewage, which is discharged to the West Herts Main Drainage Authority, became disproportionate to the population served. A method of assessing flow, used in river gauging, was used to determine volume of infiltration between sampling points. Initial measures to control infiltration were unsatisfactory, but a new chemical grouting process using Terraseal has resulted in a high degree of success. Terraseal is a form of sodium alginate capable of forming viscous solutions and of being converted to a stable jelly; addition of a suitable inhibitor to the solution during preparation prevents micro-organisms from attacking the jelly. The method of application is described.
W69-01743

'SMOKING OUT' ILLEGAL HOUSE DRAINS,
A. Larmon.
Wastes Eng, Vol 34, No 11, p 603, Nov 1963.

Descriptors: Sewers, Manholes, Equipment.
Identifiers: *Residential sewers, *Downspouts.

Smoke testing equipment consisting of portable 1500 cfm Homelite blower connected by canvas air-duct to sheet of 3/4-in. plywood lined with sponge rubber to fit over manhole was used to locate downspouts connected to sanitary sewer system in South Charleston, W Va; smoke was applied in manhole by lighting smoke bomb on suction side of blower and discharging it through manhole into sewer.
W69-01745

INFILTRATION AND SEWER FOUNDATIONS,
For primary bibliographic entry see Field 08G.
For abstract, see .
W69-01746

INFILTRATION AND SEWER FOUNDATIONS,
Tulane Univ., New Orleans, La.
John K. Mayer, F. W. MacDonald, and S. E. Steimle.
Public Works, pp 105-107, Dec, 1967.

Descriptors: *Sewers, *Construction.
Identifiers: *Sewer infiltration, *Gulf Coast.

A study on the most suitable foundation materials and best types of sewer arrangements to decrease and control infiltration in the Gulf Coast area was carried out. Various foundation materials and arrangements under various laying conditions were tested in laboratory and field studies to determine the most suitable bedding in a number of soil types common to the area. This report covers methods of

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investigation and work completed in the laboratory in silty sand and fat clay with clam shell bedding.
W69-01747

REMOTE CONTROL GROUTING OF SEWER LINE LEAKS.

James Metz.
Water Wastes Eng. Vol 5, No 6, p 68, June 1968.

Descriptors: *Sewers, *Sealants, *Equipment.
Identifiers: *Sewer infiltration.

A procedure for repairing leaks in sewer lines, known as telegROUT, involving the use of remote control grouting, is described. Equipment required in the process includes a van-type truck, chemical grout mixing and pumping equipment, sewer grouting packers and plugs, air compressor, television inspection components, winches, downhole sheaves, and communication system. A winch cable, to which is attached a television camera and sewer grouting packer, is pulled through the sewer line. The trailing winch line is attached to the grouting packer, and a communication line is placed between the two winches and the grouting engineer. The inline equipment is then moved through the sewer line. When a leak is observed on the television monitor, the grouting packer is set over the leak and sufficient chemical grout is pumped through the set packer to seal the leak. The grout requires 5 to 15 minutes to set. The television inspection system may also be used for survey work to determine the condition of lines before starting a repair program. Pictures can be made from the monitor screen for permanent records of lines being surveyed or repaired.
W69-01748

LABORATORY INVESTIGATION OF SOIL INFILTRATION THROUGH PIPE JOINTS.
E. H. Nettles, and N. B. Schomaker.
Nat Res Council-Highway Res Bd-Res Rec, No 203, pp 37-56, 1967.

Descriptors: *Pipes, *Model studies.
Identifiers: *Sewer infiltration.

Investigation of infiltration characteristics of four soils—poorly graded medium to fine sand, uniformly graded fine sand, silt, and lean clay, to develop system of classifying soils according to degree that infiltration through pipe-joint openings may be expected to occur; investigation included design and construction of model simulating prototype pipe joint, study of feasibility of using model for such studies, investigation of variables affecting soil infiltration, and investigation of infiltration of soils described.
W69-01749

SEAL SEWER LEAKS FROM INSIDE,
For primary bibliographic entry see Field 08G.
For abstract, see .
W69-01750

PING-PONG BALLS WILL TRACE POLLUTION.

Sewage Works Eng, Vol 19, p 450, Sept 1948.

Descriptors: Water pollution, *Tracers, *Sewers.
Identifiers: *Storm sewers.

Champaign-Urbana, Ill., is faced with a storm sewer problem which has apparently resulted in pollution of an area referred to as the Boneyard. The lack of funds in the budgets of the two cities had delayed a survey of the storm sewer system, but a study of sections of the sewers will be started immediately. The work will be carried out under the direction of Walter M. Kunsch, engineer-manager of the Urbana-Champaign Sanitary District. The check will be made of dropping ping-pong balls or other floating matter down toilets in the area drained by certain sections of the doubtful storm

sewer system. If the balls turn up at the Boneyard outlet for the storm sewer system, rather than at the sewage treatment plant of the Sanitary District, it will be evident that sanitary sewage is cross-connected to the storm sewers. The homes from which the ping-pong balls were discharged will be traced and the pollution corrected.
W69-01762

REPORT ON POLLUTION FROM OVERFLOWS - THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO.

Black and Veatch, Consl Engrs, Kansas City, Mo., 1962.

Descriptors: *Overflow, Water pollution, Biochemical oxygen demand, Sewage treatment, *Storm runoff, Surface runoff.

Identifiers: *Interceptor sewers, Sewer separation.

Engineering studies of the Chicago Interceptor Sewer System - including identification of system sections which limit capacity, frequency of overflows, and pollution loads (P. E.) - showed an enormous B. O. D. contribution (75%) from the sewage treatment plants in relation to the overall pollution of the waterway. Construction of additional treatment plants nearer to the source of sewage load, tertiary treatment facilities, and ultimately, complete separation of sanitary sewage from storm water, are suggested. Areas requiring further study include the feasibility of stormwater treatment facilities, the pollutational character of surface runoff and the entire industrial waste problem.
W69-01790

PRELIMINARY POLLUTION STUDY UPPER EAST RIVER.

Report to New York City and New York State Depts of Health. Lockwood, Kessler and Bartlett, Inc., (No Date).

Descriptors: *Water pollution, Sewage effluent, Sewage treatment, *Overflow, Tracers, *Chlorination, *Storm runoff.

Identifiers: *Combined sewers, *Storage tanks, New York (N. Y.).

Basic analysis of origin of pollution in upper East River indicates that these stem from discharge of unchlorinated effluents of 4 major sewage treatment plants and overflows from 80 combined sewers. Hydrographic studies detailing float studies, dye trials and tidal observations indicate travel of pollution in area. Recommendations for further studies to determine the frequency-quantity relationship of rainy weather overflow of raw sewage and to investigate the effect of Ch and/or storage on rainy weather overflows from combined studies are made.
W69-01791

INVESTIGATION OF POLLUTION OF EASTCHESTER BAY.

Bureau of Sanitary Engineering, New York City Department of Health.

Descriptors: *Overflow, *Water pollution.

Identifiers: *Combined sewers, *Bacteriological sampling.

Data presented emphasizes that overflow from combined sewers is a major contributor to pollution in area. Bacteriological sampling data is tabulated.
W69-01793

ACTIVITIES REPORT, JULY 1, 1964 - JUNE 30, 1965, BASIC AND APPLIED SCIENCES BRANCH, DIVISION OF WATER SUPPLY AND POLLUTION CONTROL.

U. S. Public Health Serv.

1965, 58 pp.

Descriptors: *Water pollution control, *Surface runoff, Sewage effluent, *Chemical analysis, Bacteriological sampling, Waste dilution.
Identifiers: *Urban drainage.

This report reviews research carried out from 1964 to 1965 by the Basic and Applied Sciences Branch of the Division of Water Supply and Pollution Control, aimed at determining causes and methods of control of water pollution. Work has included studies on the chemical and microbiological analysis of wastes; the polluting effects of urban and rural run-off; the persistence of organic chemicals in surface waters and their amenability to biological degradation; the effects of pollution on aquatic life and on municipal water use; methods of waste treatment, including advanced treatment of sewage; and control of surface-water quality by dilution and by removal of nutrients from effluents. A list of papers published during the year is appended.
W69-01794

THE DAY-TO-DAY POLLUTION PROBLEMS OF THE THAMES ESTUARY,

L. C. Betts.
J Proc Inst Sew Purif, Pt 1, pp 48-63, 1964.

Descriptors: *Estuaries, *Storm runoff, Discharge (Water), *Water pollution control, Legislation.
Identifiers: *Thames estuary.

The author outlines some of the sources of pollution of the Thames estuary and their effects, including shipping, stormwater discharges, used cooling water, sewage-works effluent, trade effluents, and miscellaneous sources, and indicates some of the measures being taken to reduce pollution, including legislation and the work of the Port of London Authority.
W69-01797

OBSERVATIONS ON THE RECOVERY OF A BRITISH RIVER FROM GROSS ORGANIC POLLUTION,

R. O. Brinkhurst.
Hydrobiologia, Vol 25, pp 9-51, 1965.

Descriptors: Sampling, Water pollution control, Overflow, *Storm runoff, *Bioindicators.
Identifiers: Derbyshire (Great Britain).

Until 1957 the lower reaches of the river Derwent, Derbyshire, were heavily polluted with effluents from Derby sewage works and from an industrial plant and with heated cooling water from the latter and from a power plant; in 1957, a new sewage works was put in operation to treat both sewage and the industrial waste water and cooling towers and recirculation systems were installed to control the heated discharges. Since then, several biological surveys of the river above and below the sewage works have been carried out; results are tabulated and discussed. Immediately after the removal of the gross pollution there was a dramatic recovery in the condition of the river, but this was followed by a period of fluctuating conditions and there is now a uniformly poor fauna of tolerant species at all stations in spite of the chemical evidence that the river is cleaner above the sewage works than below it; it is concluded that no further improvement can be expected until upstream sources of pollution (mostly small sewage works and storm-sewage overflows) are improved and the flushing of polluted tributaries is prevented. Particular attention has been paid to the Oligochaeta in the river, and the results confirm that these organisms, when identified to species and estimated quantitatively, can be useful in assessing pollution.
W69-01799

THE DETERGENT CONTENT OF RIVER WATER AS A FUNCTION OF WATER FLOW.

W. Bucksteeg, and N. Wolter.
Water Res, Vol 1, pp 325-333, 1967.

Sources of Pollution—Group 5B

Descriptors: *Storm runoff, Outlets, *Detergents, Water pollution, *Waste dilution.

The content of detergent in river water is lowered as the water flow increases because of the dilution, but the total amount of detergents, or the load, rises. This increase is caused by the discharge of sewage without biological treatment through stormwater outlets and by the reduction of the retention-time in the river during the high flow. Both factors diminish the possibility of biological decay, so that the relationship between water flow and detergent load is a result of more or less complete biodegradation. It is influenced by the temperature and degradability of the detergents. The introduction of soft detergents since October 1964 has caused an important decrease in detergents at low and medium water flows. The advantage of soft detergents is therefore masked by the growth of detergent use in recent years.

W69-01800

CHEMICAL AND PHYSICAL COMPARISON OF COMBINED AND SEPARATE SEWER DISCHARGES.

R. J. Burn, D. F. Krawczyk, and G. L. Harlow. J Water Poll Control Fed, Vol 40, No 1, p 112, Jan 1968.

Descriptors: Discharge (Water), *Biological oxygen demand, Sewers.

Identifiers: *Combined sewers, *Storm sewers, *Suspended solids, Ann Arbor (Mich), Detroit (Mich).

A comparative study of separate storm-sewer discharges in Ann Arbor, Mich., with combined discharges in Detroit showed that the BOD in the separate discharges was about 20 percent of that in the combined discharges. Concentrations lessened as discharge progressed. Values for total and volatile suspended solids and for total and volatile settleable solids were higher in the separate system because of greater erosion in hillier terrain. Phosphates were higher in combined flows, but nitrates were lower. Higher concentrations also were found in the combined system for phenols, NH₃-N, and organic N. In the separate system, BOD was fairly constant throughout the year, but in the combined system summer BOD's were higher. Both systems showed lower phosphate concentrations in autumn.

W69-01801

BACTERIOLOGICAL COMPARISON BETWEEN COMBINED AND SEPARATE SEWER DISCHARGES.

R. J. Burn, and R. D. Vaughan. J Water Poll Control Fed, Vol 38, No 3, p 400, March 1966.

Descriptors: Discharge (Water), Sewers, *Coliforms, *Runoff.

Identifiers: *Combined sewers, *Storm sewers.

Comparison of discharges from combined and separate sewer systems in two Michigan cities showed that total coliform concentrations in runoff carried by separate storm systems are about one tenth of those in combined sewers. Fecal coliform densities in combined systems are about 20 percent of total coliform densities, but are usually a lesser percentage in separate systems. Fecal streptococcus densities in combined systems are only about twice those in separate systems. Ratios of fecal coliforms to fecal streptococci for the systems indicate that fecal coliforms in separate sewer discharges are primarily of non-human origin, and those in combined sewer discharges are of human origin.

W69-01802

SOURCE AND PERSISTENCE OF NEMATODES IN SURFACE WATERS.

N. Chaudhuri, R. Siddiqi, and R. S. Engelbrecht. J Amer Water Works Assoc, Vol 56, pp 73-88, Jan 1964.

Descriptors: *Subsurface drainage, *Surface runoff, *Sewage effluent, *Bioindicators, Sampling, Water pollution.

Identifiers: *Bacteriological sampling, *Urban drainage.

The importance of collecting large volumes of water to composite nature to obtain representative samples is stressed. The 5 mu membrane filters yield a complete recovery of nematodes. Subsurface drainage, surface runoff, and waste treatment effluent are the 3 main sources of nematodes in surface waters, but only the waste effluent carries high concentrations of nematodes. Urban drainage has a higher nematode content than that of rural area. The nematode load of a stream receiving rural drainage appears to be related to the flushing capacity of the runoff and of the stream and to the carrying capacity of the stream. The persistence of nematodes in streams appears to be related to the mean stream temperature, the stream temperature changes, the rate of flow of the stream, and the nature of the nematode population. The pattern of seasonal variation in nematode populations in streams appears to be the same regardless of the source of nematodes.

W69-01805

FOCUS ON POLLUTION REDUCTION IN SCOTLAND,

R. W. Covill. Survr, Vol 130, No 3938, pp 25-6, Nov 25, 1967.

Descriptors: *Water pollution control, *Surface runoff, Drainage, Estuaries.

Identifiers: *Scotland.

Industrial and population growth increased number and density of water discharge points along rivers, locks and estuaries, and similarly volume and strength of such discharges have increased; industrial effluents include organic, inorganic, radioactive, and pollution resulting from heated effluents; land drainage comprises silt pollution, surplus irrigation water, surface water runoff and agricultural particles and fertilizers; responsibility for water resources management should be vested in one organization covering functions of potable and industrial water supply, drainage, and municipal and industrial water treatment and pollution prevention.

W69-01806

FIELD STUDIES ON THE FLOW AND COMPOSITION OF STORM SEWAGE,

R. N. Davidson, and A. L. H. Gameson. Symposium on Storm Sewage Overflows, May 4, 1967. Sponsored by the Institution of Civil Engineers (Gt Brit).

Descriptors: *Overflow, *Storm runoff, *Sampling, *Biochemical oxygen demand, *Water pollution.

Identifiers: *Suspended solids.

Investigations on sewers draining three areas, one in Northampton, one in Bradford, and one in Brighouse resulted in data from which several graphs and equations were derived and used to estimate the effect of changes in overflow setting on the frequency duration and volume of discharge from a hypothetical overflow. The overflows at Brighouse and Bradford did not conform to such ideal conditions. Calculations indicated that the flow at which first spill should occur might vary by over 3%. These particular overflows are discussed and the various ways of expressing overflow settings are summarized. An automatic sampler was used at each site for storm sewage. There was a tendency for the strength of sewage to decrease with time during a storm. Variations in average composition of storm sewage with ratio of excess flow to total flow are given. Tables are included of the average maximum values of suspended solids and BOD, the multiples of daily dry weather load discharges from hypothetical overflow at Northampton, and existing overflows at Bradford and Brighouse in a year of average rainfall.

W69-01807

BACTERIAL SURVEY OF STREAMS AND BATHING BEACHES AT CLEVELAND,
J. S. Delos.

Sewage and Industrial Wastes, Vol 22, No 12, pp 1618-24, Dec 1950.

Descriptors: *Water pollution, *Recreation facilities, *Storm runoff, *Overflow, *Coliforms, Bioindicators.

Identifiers: Bacteriological sampling, Cleveland (Ohio).

This article is a condensation of the original report submitted to the Commissioner of Sewage Disposal and covers the 1949 survey and a comparison with earlier pre-war studies. The objects of the 1949 survey were: (1) To determine the present level of pollution of the bathing beaches as compared to prewar level. (2) To determine the effect of storm water overflows on the pollution level. (3) To determine the quality of water flowing in the streams discharging into the lake. Brief description of testing, areas tested and short tables of data are included. Conclusions reached were that coliform count definitely increased during wet period. For a given period, the number of days of rain has a greater effect than the amount of rain which fell at a particular period.

W69-01808

POLLUTION PREVENTION IN NORTHERN IRELAND,

T. R. Graham. Effluent Water Treatment J, Vol 7, No 1, pp 35-37, Jan 1967.

Descriptors: *Water pollution, *Storm runoff, *Overflow, Rainfall intensity.

Identifiers: *Combined sewers, *Storage tanks, Northern Ireland.

A general report on current water quality conditions in Northern Ireland at a time of intense expansion involving the growth of cities, creation of a city, construction of a motorway network, and the doubling of ferry capacity between Britain and Northern Ireland is presented. The need for future legislation that will prevent and control pollution from industrial and agricultural effluents is stressed. Where there are combined sewers, high rainfall in some areas causes much direct pollution from storm sewage and prevents adequate retention time of storm water at the works. New development areas have separate sewage systems. In a few areas storm-water is settled by tanks at the overflow, with occasional desludging.

W69-01818

SOURCES AND CONTROL OF RIVER POLLUTION,

R. D. Hoak. Instruments, Vol 25, No 12, pp 1714-6, Dec 1952.

Descriptors: *Storm runoff, *Water pollution, Water pollution control, *Instrumentation.

Identifiers: *Urban drainage.

Five principal sources are erosion, storm water runoff from urban areas, domestic sewage, industrial waste and acid mine waters; varieties of pollution which result from these causes; extent of stream self purification; pollution control and types of instruments applicable.

W69-01822

PATHS OF POLLUTION IN NEW YORK HARBOR-MODEL STUDY,

W. T. Ingram, and H. Mitwally. Water Poll Control Fed J, Vol 38, No 10, pp 1563-81, Oct 1966.

Descriptors: *Path of pollutants, *Model studies, *Water pollution, *Storm runoff, Overflow, Estuaries.

Identifiers: New York (N Y).

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

Extensive study utilized dye releases in model of New York Harbor to trace paths followed by pollutants discharged at particular points; influences of installed jetties and dikes on pollution paths and relationship between release concentrations at source of pollution developed by individual tests and those shown by simultaneous release from multiple sources were investigated; pollution sources were wastewater treatment plants and stormwater overflows; this type of study is useful in predicting effects on pollution paths of changes in harbor configuration and waste discharge before such changes actually are made in prototype.

W69-01828

THE POLLUTION OF RUN-OFF FROM URBAN HOUSING ESTATES,

For primary bibliographic entry see Field 04C.

For abstract, see .

W69-01831

SEWAGE LOAD OF RECEIVING STREAMS FROM MIXED SEWERS,

H. H. Mueller.

Gas-Wasserfach, Vol 109, No 6, pp 143-147, 1968.

Descriptors: *Water pollution, Sewage treatment, *Storm runoff, *Overflow.

Identifiers: *Calculations, *Storage tanks, *Capacity, *Combined sewers.

Investigations into the determination of the amount of impurities which are annually introduced, under specific combinations of control measures, into receiving streams are described. Fundamental theories and assumptions are presented, followed by the corresponding calculations. The balance of impurities shows that the introduction of rainwater settling tanks into the treatment considerably increases the efficiency which also depends on the chosen critical rainfall and the size of the tanks. The (1+4)Q sub s infed to the sewage plant results in favorable efficiency only for small critical rainfalls and small tanks. Larger tanks are best used when the (1+1)Q sub s infed to the plant is observed. In size determinations, consideration should preferably be given to a critical rainfall of 10 to 15 l/s.ha. Rainwater hold-up time in the settling tanks should be at least 10 minutes. However, if it is possible to install a large collecting main with a high threshold for the rainwater overflow, an equivalent effect would be obtained with a hold-up time of about 3 minutes for the maximum infed.

W69-01840

MERRIMACK RIVER POLLUTION ABATEMENT STUDY,

P. W. Prendiville.

Boston Soc Civ Engrs, Vol 51, pp 316-328, 1964.

Descriptors: *Storm runoff, *Overflow, *Water pollution control, Sewage treatment, Sewage lagoons, Estuaries.

Identifiers: Merrimac River (Mass.).

In view of the increasing pollution of the Merrimack River, which is formed in New Hampshire by the confluence of the Pemigewasset and Winnipesaukee Rivers and flows through Massachusetts to the Atlantic Ocean, surveys have been carried out to determine the present condition of the river and the degree of treatment required for sewage and trade waste waters discharged to it. The results of the investigations on the extent of organic and bacterial pollution and the polluting effects of overflows of mixed sewage and storm water are discussed briefly. Various alternative plans for sewage treatment have been considered, and it was recommended that the individual communities and metropolitan regions should be responsible for constructing the necessary sewage-treatment facilities; these would include extended-aeration plants, primary treatment plants, and sewage lagoons. An industrial survey showed that all the trade waste waters in the area can be treated in the municipal plants, after preliminary treatment at the source in some cases.

W69-01846

POLLUTION STUDY OF A FUTURE TIDAL ESTUARY,

C. A. Rambow.

J Water Poll Control Fed, Vol 36, pp 520-528, 1964.

Descriptors: *Estuaries, Surface runoff, *Flood control, *Dissolved oxygen, *Path of pollutants, Outlets, *Biochemical oxygen demand.

Identifiers: *Los Angeles (Calif.).

Dominguez channel is a natural watercourse carrying surface run-off and waste discharges from an area south-west of Los Angeles into the east basin of Los Angeles Harbour. During heavy rainstorms, flooding occurs, and the lower portion of the channel is now being improved to control this. The design is such that the invert will be below mean sea level for a distance upstream of more than 8 miles, and the finished channel will therefore constitute a tidal estuary. At present, the waste waters discharged to the channel are too strong for biochemical action to occur, but when diluted with a large volume of sea water it is possible that biochemical degradation will occur in the channel, with depletion of dissolved oxygen and formation of odours. Theoretical analysis was, therefore, used to estimate the waste-assimilating capacity of the improved channel; this involved calculation of the spread of pollutants from the various outfalls, estimation of the oxygen resources of the channel, and comparison of oxygen demand with oxygen resources to determine the most critical point of the channel. By equating B.O.D. to oxygen supply at this point, an oxygen sag curve for the channel was obtained for the calculated B.O.D. loadings; this curve can be used as the basis for siting future outfalls and for determining the allowable discharge of B.O.D. by various industries.

W69-01847

THE PERMISSIBLE DILUTION AT STORM WATER OUTLETS,

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01853

PUBLIC HEALTH - WATER SUPPLY.

Mass Ann Laws ch 111, secs 159-175 (1967).

Descriptors: *Massachusetts, Legislation, Administration, *Administrative agencies, Water policy, Water pollution control, Water pollution sources, *Water quality, Water requirements, Permits, Pollution abatement, *Regulation.

The department of public health is given general supervision over all inland water sources used by cities, towns, public institutions, etc. A permit from the department is required before anyone may make a cross connection between a water distribution system for domestic water and one for water not approved by the department. The department may, upon petition and after public hearing order the abatement of pollution. Appeals are provided for, and either the supreme judicial or the superior court is to enforce the orders of the department. Agents of the department may enter any premises to find whether sources of pollution exist there, or to see if the department's orders are being followed. Several rivers are exempted from these provisions. No polluting matter may be discharged into any body of water which is a water source for domestic uses, but prescriptive and legislatively granted rights are not to be affected by this provision. Pollution may be enjoined by either the supreme judicial or the superior court. A penalty is set for willful defilement of a water source or conductor, and for bathing in a source of water for domestic use. Arrests without warrant are authorized for such violations. Driving animals across ice to be cut for domestic purposes is forbidden. Special provisions are made to protect the Charles River from pollution. (Williams-Fla)

W69-01938

WEST KY COAL CO V RUDD (ACTION BY FARM OWNER AGAINST 8 COAL MINING COS TO ENJOIN DISCHARGE OF COAL WASTES).

328 S W 2d 156-161 (Ct App Ky 1959).

Descriptors: *Kentucky, Judicial decisions, Farms, *Coal mine wastes, *Rivers, *Overflow, Damages, Water pollution, Sewage, Prescriptive rights, Drainage, Mining, Minewater, Acid mine water, Mine acids.

Identifiers: Injunction, Equity.

An action was brought by a farm owner against 8 coal mining companies to enjoin the discharge of coal slack, copperas waters, and other deleterious substances into the waters of a river from which they were deposited on his farm during overflow periods, causing damage to productivity and fertility. The farm owner also sought damages. The trial court granted the injunction and ordered the damages issue transferred to a common law docket for a jury trial. The appellate court held that where a court of equity had taken jurisdiction, the plaintiff was properly not required to elect which company he would seek damages against, although the companies were not joint tortfeasors. The statute requiring water to be drained as directly as practicable to adjacent streams or watercourses from mines was designed only to require that the water be kept out of working places for safety purposes. It could not be construed as direction or permission to pollute waters, but if the statute could be so construed, it would have been impliedly repealed by the pollution statutes. (Watson-Fla)

W69-01957

ROLE OF SILT IN WATER POLLUTION,

For primary bibliographic entry see Field 02J.

For abstract, see .

W69-01968

NORTH DADE WATER CO V ADKEN LAND CO (INJUNCTIVE RELIEF FROM DRAINING OF EFFLUENTS INTO PRIVATE LAKES).

114 So 2d 347-348 (3d D C A Fla 1959).

Descriptors: *Florida, Judicial decisions, *Effluents, *Drainage effects, Public health, Sewage bacteria, *Water pollution, Sewage effluents, Water pollution sources.

A temporary injunction was granted by the trial court, enjoining the North Dade Water Company from draining effluent into two land locked lakes located on appellee's property. Appellant discharged effluent into Myrtle Lake, which is joined with appellee's lakes by a culvert which was recently installed. Appellee presented evidence showing sewage in both of his lakes and attesting to a strong odor in the area of Myrtle Lake. The appellate court upheld the decision, stating that the judge must have considered possible future pollution and its effect on the health and welfare of the surrounding property owners. (Sisserson-Fla)

W69-01948

5C. Effects of Pollution

COMPARISON OF THE DISTRIBUTION OF ORGANIC MATTER IN THE FIVE GREAT LAKES,

Michigan Univ., Ann Arbor, Great Lakes Research Div., Inst. of Science and Tech.

Andrew Robertson, and Charles F. Powers.

Part of final rept. of USPHS Grant WP-00311. Michigan Univ Spec No 30 of the Great Lakes Res Div pp 1-18, 1967. 18 p, 7 tab, 3 fig, 22 ref. ONR-104-818.

Descriptors: *Eutrophication, *Great Lakes, Nutrients, Plankton, Zooplankton, Productivity, Surface waters, Water quality, Dissolved solids, Organic matter, Biological properties.

Identifiers: *Particulate organic matter, Macrobenths.

Effects of Pollution—Group 5C

Particulate and dissolved organic matter were measured in all 5 of the Great Lakes and the biomass of zooplankton and macrobenthos were measured in the upper 3 lakes. In general, total organic matter increases in the order, Superior, Huron, Michigan, Erie, Ontario, the same order as shown by total dissolved solids and total dissolved organic matter. This may also represent their relative states of eutrophication. Dissolved organic matter content in the surface waters is 2.22-2.98 mg/l in Lake Superior, 2.52-2.91 mg/l in Lake Huron, 3.24-5.81 mg/l in Lake Michigan, 5.82-6.01 mg/l in Lake Erie, and 5.85-6.53 mg/l in Lake Ontario. The particulate organic matter is much greater than the amounts of zooplankton and macrobenthos. (Knapp-USGS) W69-01620

PESTICIDE OCCURRENCE, CONCENTRATION AND DEGRADATION IN FREE WATER SYSTEMS,

Massachusetts Univ., Amherst.

C. W. Miller, B. M. Zuckerman, and H. B. Gunner.

Mass Univ. Water Resources Res Center, Symp Proc, Publication No 3, pp 94-99, June 2, 1967. 6 p, 5 tab, 5 ref.

Descriptors: *Pesticide kinetics, *Pesticide residues, *Degradation (Decomposition), *Translocation, Cranberries, Diazinon, Dieldrin, Fish, Mussels, Fresh Water, Irrigation.

Identifiers: *Pesticide concentration, Parathion, Cranberry bogs.

The degradation and movement of pesticides used in cranberry bogs were studied to relate application practices to pesticide pollution. Dieldrin is usually applied in granular form once every 4-5 yr. Soil samples 12 in. deep were collected from areas with past histories of dieldrin applications. Analyses indicated that very little vertical leaching occurs even after 10 yr, probably because of high organic content of the soil. None has been observed in solution in drainage water. The effect of flooding on movement of diazinon and parathion was studied by flooding a greenhouse model of a cranberry bog on which the chemical had been applied at field rates. About 4.6% of the diazinon and 6.5% of the parathion were present in the flood waters. Parathion concentration decreased from 0.07 ppm to 0.002 ppm and diazinon decreased from 0.32 ppm to 0.01 ppm, in 144 hours. It is recommended that no bogs be flooded for at least 72 hr following pesticide application, and that when water flows through a bog, less hazardous chemicals be used. (Knapp-USGS) W69-01634

ADSORPTION OF PESTICIDES ON EARTH MATERIALS,

Massachusetts Univ., Amherst, Dep of Plant and Soil Sciences.

J. H. Baker, and Oh Young Shin.

Mass Univ. Water Resources Res Center, Symp Proc, Publication No 3, pp 75-88, June 2, 1967. 14 p, 5 fig, 7 tab, 7 ref.

Descriptors: *Pesticide kinetics, *Adsorption, *Earth materials, Soils, Clays, Soil water, Diazinon, Herbicides, Organic matter, Leaching.

Identifiers: Atrazine, Stream sediments.

Preliminary experiments were performed to determine the effects of time, salt concentration, and concentration of atrazine and diazinon on the adsorption of atrazine and diazinon, which are commonly used pesticides, on soils. Equilibrium was attained within 6 hr. Atrazine adsorption was constant over the range of salt concentration to be expected in soil water, but increased greatly at a concentration of 0.5 moles per liter. The amount of atrazine absorbed is a linear function of atrazine concentration. The only soil property that seemed to be related to atrazine adsorption was organic content. The adsorption of atrazine on pure clay minerals was studied and the results are presented in tables. Diazinon was more strongly adsorbed

than atrazine, and its adsorption is more affected by organic content. Tabulated data include the effect of time of reaction on atrazine adsorption, the effect of calcium chloride on atrazine adsorption, distribution coefficients for atrazine adsorption on 21 soils, linear regression coefficients relating atrazine adsorption to organic content, distribution coefficients for diazinon adsorption on 16 soils, and hydrolysis of diazinon in the presence of montmorillonite. (Knapp-USGS) W69-01635

STUDIES OF MILWAUKEE HARBOR AND EM-BAYMENT,

Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.

John C. Ayers, and Joseph C. K. Huang.

Michigan Univ Spec Rep No 30 of the Great Lakes Res Div, pp 372-394, 1967. 22 p, 9 fig, 2 ref.

Descriptors: *Water pollution effects, *Lake Michigan, *Eutrophication, Pollutants, Turbidity, Color, Dissolved oxygen, Oligochaetes, Bioindicators, Amphipoda, Bottom sediments, Benthos.

Identifiers: *Water-borne parameters, Milwaukee Harbor.

The quality of water and the biological associations of Milwaukee Harbor water and adjoining Lake Michigan water were studied to learn the mutual effects of the heavily polluted harbor on the lake and of the clean lake on the harbor. Milwaukee harbor is enclosed by a breakwater and heavily polluted by the Milwaukee River and by a sewage outfall just south of the river inside the breakwater. Municipal water intakes are located to the north and south of the harbor entrance and obtain good quality water. The distribution of oligochaetes, sphaeriids, and amphipods, as well as of transparency sulfides, and dissolved solids indicate that Milwaukee harbor is functioning as a sewage lagoon in which settlement and mineralization take place. Currents move generally northward in the area from September through March and southward from April through August. Polluted water from the harbor seldom reaches the intakes to the city water system, and on the few occasions it does it is much diluted by lake water and somewhat purified by its residence in the harbor. (Knapp-USGS) W69-01649

THE INTERNAL DISTRIBUTION OF ANALYSIS VALUES AS AN INDICATOR OF EUTROPHICATION,

Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.

John C. Ayers.

Michigan Univ Spec Rep No 30 of the Great Lakes Res Div, pp 395-411, 1967. 17 p, 7 fig, 4 tab, 7 ref.

Descriptors: *Eutrophication, *Indicators, *Lake Michigan, *Statistical methods, Frequency analysis, Dissolved solids, Nitrogen, Phosphorus, Seston, Sulfates, Conductivity.

Identifiers: Skewness, Kurtosis.

The skewness and kurtosis of frequency curves of chemical analysis data of Lake Michigan water and sediments were used to show subtle changes in the early stages of eutrophication. The data analyzed are concentrations of orthophosphate, sulfate, seston ash, total dissolved solids, total phosphorus, nitrogen by Kjeldahl analysis, and conductivity. Definite differences in skewness and kurtosis were found in the distribution of the analyzed concentrations between sampling lines across the industrialized and eutrophying southern end of the lake and sampling lines farther north. The northern data were more skewed and peaked in phosphorus, sulfate, conductivity, and seston ash. The southern lines were more skewed and peaked in nitrogen ashfree dissolved solids, and total dissolved solids. (Knapp-USGS) W69-01650

PERMISSIBLE WATER POLLUTION AT COMBINED SEWER OVERFLOWS,

G. Akerlindh.

Sewage Works J, Vol 21, No 6, p 1059, 1949.

Descriptors: *Overflow, *Water pollution, Dissolved oxygen, Coliforms.

Identifiers: *Combined sewers.

By plotting the hours duration of storm-water overflow against allowable D.O. content and coliform density in the stream, on double log diagrams, the author presents a method for estimating the permissible storm water overflow in a receiving body of water.

W69-01681

THE BACTERIOLOGICAL EFFECT OF COMBINED SEWER OVERFLOWS ON THE DETROIT RIVER,

R. J. Burn.

J Water Poll Control Fed, Vol 39, No 3, p 410, March 1967.

Descriptors: *Overflow, Discharge (Water), *Coliforms, *Water quality, *Rainfall intensity.

Identifiers: *Combined sewers, Detroit (Mich).

A study of water quality at various points in the Detroit River before and after rainfalls causing overflows of combined sewers showed that, in at least this case, effects of these overflows persist for several days after discharge has ceased, with duration of effects increasing with increase in the intensity of the storm. Bacterial densities may increase a thousandfold after moderate rains at sampling points, within several miles downstream from combined sewer outfalls. Farther downstream, increases in bacterial densities are less, but occur over greater portions of the stream width. Fecal coliforms and fecal streptococci follow patterns similar to those of total coliforms.

W69-01730

POLLUTION EFFECTS OF STORMWATER AND OVERFLOWS FROM COMBINED SEWER SYSTEMS.

Public Health Service Pub No 1246, 1964.

Descriptors: *Storm runoff, *Overflow, *Water pollution control, Sewage treatment, Sewers, Water pollution, *Control, Cities.

Identifiers: *Combined sewers.

The purpose of this report is to examine and assess in a preliminary way existing data on stormwater and combined sewer overflows in regards to characteristics and pollution effects, and to investigate existing and possible corrective measures for dealing with the problem. The sources of data include more than 50 engineering reports and completed questionnaires regarding sewer systems and/or sewage treatment, reports of detailed studies of water quality data and stormwater separations, and interviews with municipal sanitation representatives. These sources provide information on (a) quantity and quality of combined sewer overflows; (b) effects on streams, water uses, and users; (c) adverse effects, and if any, existing or suggested control measures and their effectiveness; and (d) costs necessary for control.

W69-01795

SELF-PURIFICATION IN MUSSELS FROM THE MEDITERRANEAN-ITS USEFULNESS - ITS ACCOMPLISHMENT-RESULTS OBTAINED,

R. Buttiaux, and R. Ferrand.

Symp Comm Int Explor Scient Mer Medit, Monaco, 1964, pp 299-306, 1965.

Descriptors: *Water pollution, *Storm runoff, Outlets, *Overflow, *Pathogenic bacteria, Standards, *Shellfish.

Identifiers: *Bacteriological sampling, Toulon (France), Interceptor sewers.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

Mussels cultivated in Lazaret bay, Toulon, France, are subjected to much pollution and have in the past caused serious typhoid epidemics. The bay, which is almost completely enclosed, being connected with the open sea by only two narrow passages, receives waste waters from the dockyard and from warships anchored in the harbour; polluting material is also carried into the bay by run-off, during the heavy storms which are frequent in this region; and although an intercepting sewer, with an outfall outside the bay, has been built to divert a large part of the municipal sewage, the storm-sewage overflows still discharge into the bay itself, and the water and mussels still suffer faecal contamination, as shown by tabulated data. Although bacteriological examination of water in the bay before and after a period of 5 hours' sunshine showed an important reduction in the numbers of *Escherichiaeae*, the bactericidal action of sea water is slow, especially in the case of *Salmonella*, and it is too slow to prevent the penetration of salmonellae into molluscs. A plant was therefore set up at Toulon for the self-purification of shellfish in clean sea water and the bacteriological quality of mussels was assessed before and after treatment, on the basis of standards proposed for the content of *Escherichia coli* and *Streptococcus D*. Good results were achieved as regards the protection of public health, with no loss in the organoleptic quality of the shellfish.

W69-01803

STORM-WATER INVESTIGATIONS AT NORTHAMPTON, A. L. H. Gameson, and R. N. Davidson. *J Inst Sew Purif*, Pt 2, 1963.

Descriptors: *Flow measurement, *Biochemical oxygen demand, *Storm runoff, Water pollution, *Overflow, Sewage effluent, Sewage treatment.
Identifiers: *Suspended solids, *Storage tanks, *Capacity.

Tabulated and graphical results are given of studies carried out at Northampton over a period of 2 years on the flow and composition of sewage in a main sewer, with no overflows, particularly during wet weather. It was found that the strength of the storm sewage entering the system, as judged by the B.O.D., was less at high flows, decreased with time since the start of the storm, and increased with length of time since the previous storm. The storm sewage contained a higher concentration of suspended solids than did crude sewage, the greatest concentration of solids being associated with the first flush of storm sewage and this maximum value was greatest when the storm had been preceded by several days of dry weather. The polluting effect of the first flush of storm sewage is attributed to the scouring out of grit and organic solids deposited in the system during dry weather. It was estimated that, had the system been provided with a storm-water overflow, raising the setting of the overflow by one times dry-weather flow would have roughly the same proportional effect throughout the range from 3 to 30 times dry-weather flow, and no substantial reduction in the amount of polluting matter discharged would be achieved by a small change in the setting. However, the provision of storage capacity equivalent to 2-hour dry-weather flow at the overflow would reduce the B.O.D. load discharged from an overflow set at 6 times dry-weather flow by about 40 per cent, and trebling the storage capacity would reduce the load by a further 20 per cent of the initial value, equivalent to raising the overflow setting to 11 times dry-weather flow. The average B.O.D. load discharged per year from an overflow set at 6 times dry-weather flow would be nearly as great as the B.O.D. load discharged as sewage-works effluent during the same period if the whole flow to treatment were discharged as effluent with B.O.D. of 20 ppm and the suspended solids discharged would be equivalent to 3 times the load in a sewage effluent containing 30 ppm solids. It is stressed that the results of this investigation cannot be applied to other sewerage systems until comparable data are available for other sites.

W69-01816

THE RETENTION OF POLLUTING MATTER FROM STORM OVERFLOWS,

H. Guntzel.
Gesundheits-Ing, Vol 56, 1933.

Descriptors: *Storm runoff, *Water pollution, *Overflow, Weirs, Design.
Identifiers: *Suspended solids.

Discusses the effect on streams of polluting matter carried by storm water from sewer overflows, conditions of flow at overflow weirs, different methods of retaining solid matter (screens, settling tanks, baffles, etc.) and their advantages, disadvantages and possible improvement. A design of overflow is suggested in which the overflow water passes through screens inclined at such an angle that the screening can be returned by an automatic scraper. The installation of a screening plant permits the discharge of greater quantities of storm water into a stream as the dilution necessary is less for screened than for unscreened storm water. The economics of storm water treatment are discussed.

W69-01819

EFFECT OF STORM OVERFLOWS ON RIVER QUALITY,

W. F. Lester.
Symp on Storm Sewage Overflows, May 4, 1967.
Sponsored by the Institution of Civil Engineers.

Descriptors: *Water quality, *Overflow, *Storm runoff, Discharge (Water), *Water pollution.
Identifiers: *Storage tanks.

It is assumed that the 'standard' storm sewage overflow in excess of 6 d.w.f. flows to a river which has a rate of flow of 1, 10, and 100 times d.w.f. of the sewage. It is shown that the quality change with increase in rate of flow will depend on the initial quality of the stream. A table indicates the quality of river water below storm overflows. Because the discharges contain more carbohydrates and higher organic compounds than fully treated effluent there is a greater tendency to form fungal growths below overflows. The discharge of *E. coli* content increases. The concentrations of toxic materials may be critical from sewers containing industrial wastes. Where rivers are used for direct abstraction of water for potable supplies, overflows cause rapid changes in quality. Fractured sewers can also cause pollution of rivers. The discharges from 'standard' storm tanks will have as much as 80% reduction in pollutive effects on rivers. Brief reports are made on surveys of the River Trent and Tame to determine the effect of storm discharges on these two rivers.

W69-01833

PROBLEMS IN THE CALCULATION OF STORM WATER OVERFLOWS,

W. Losse.
Gas Wasserfach, Vol 29, pp 84-5, 1958.

Descriptors: *Storm runoff, *Overflow, Water pollution, *Rainfall intensity, Design.

The author discusses, from personal experience and from the literature, the amounts of rainfall for which storm water overflows should be designed in order to avoid pollution of the receiving stream. Amounts between 6-10 liters/sec./ha are suggested, varying according to the stream, the slope of the land, and the condition of the sewerage system. The figures must be tested by careful investigation. Calculation of storm water overflows according to amounts of rainfall is preferable to calculation by a mixing ratio which may give a false impression of the load of the stream.

W69-01834

THE STORM-SEWAGE POLLUTION PROBLEM,

C. Lumb.
J Proc Inst Sew Purif, 1964, Pt 2, p 168, 1964.

Descriptors: *Storm runoff, *Overflow, *Water pollution, Design, Sewers, Sewage treatment.

Identifiers: *Combined sewers, *Sewer separation, *Storage tanks.

The author discusses the polluting effects of storm sewage overflows from combined sewerage systems and methods for reducing such pollution, including the installation of separate sewerage systems, the use of overflow settings higher than the conventional 6 times dry-weather flow, improved design of overflows, screening of storm sewage, and provision of storage facilities at overflows to receive the first flush of the discharge and return it later to the foul sewer. Pollution may also be caused by discharges of partially treated storm sewage from storm-sewage tanks at sewage works; this can be reduced by increasing the flows to be given full treatment and by improved design and operation of storm-sewage tanks.

W69-01835

STORM WATER POLLUTION CONTROL,

Gordon E. McCallum, and Leo Weaver.
Interstate Conf on Water Problems, Dayton, Ohio, Dec 10, 1965 p, 12 ref.

Descriptors: *Storm runoff, *Water pollution, Sewage treatment.
Identifiers: *Combined sewers, *Storm sewers, *Sewer separation, Storage tanks.

Inadequacies of combined sewage systems are discussed. Pollution by storm water runoff is described. Government grant projects aimed at solving this problem are outlined. The costliness and relative insufficiency of complete separation of storm sewers from sanitary sewers is mentioned, and the need for new alternative solutions (e.g. holding tanks, treatment) emphasized.

W69-01836

THE POLLUTANT EFFECTS OF STORM WATER OVERFLOWS FROM COMBINED SEWERS,

C. L. Palmer.
Sewage and Industrial Wastes, Vol 22, pp 154-65, 1950.

Descriptors: *Water pollution, *Storm runoff, *Overflow, Rainfall intensity, Water pollution control.

Identifiers: *Combined sewers, Capacity, *Interceptor sewers.

The author discusses the effects of pollution caused by overflowing of storm water from a combined sewer system. The characteristics of low intensity storms in the Detroit area were first studied and the results shown in graphs. It was found that runoff did not occur unless precipitation was greater than 0.03 in/hr and storm water would not overflow unless precipitation was more than 0.03 in/hr. plus the capacity of the sewers for storm water. It was found that intercepting sewers are most effective in preventing overflow when they have a capacity of 150% of the sewage flow, and no satisfactory reduction in number of duration of overflows is achieved by increasing the capacity to any reasonable extent. The quality of the overflowing liquid varies considerably and would be highly polluting even from a separate system, the cost of which is not commensurate with the reduction in pollution which it would effect. A properly designed combined sewerage system should be about 99% effective in preventing pollution by storm water overflows.

W69-01843

SEWERAGE SYSTEMS AND RIVER POLLUTION,

J. A. Pickford.
J Royal Soc Health, Vol 87, No 1, pp 36-42, Jan-Feb, 1967.

Descriptors: *Water pollution, *Discharge (Water), *Rainfall intensity, *Storm runoff, *Overflow, Sewers, Water pollution control.
Identifiers: *Combined sewers, *Storm sewers, *Sewer separation, *Capacity.

Effects of Pollution—Group 5C

The effect of discharge of combined, separate, or partially separate sewer systems on river pollution is discussed. Factors affecting the quantity of storm sewage are rainfall and run-off, overflow devices, and the storage capacity of sewers. Several overflow devices are discussed. It is suggested that the increase of treatment plant capacity, the provision of larger sewers, and the provision of selective types of overflow are likely to cost much less than the provision of completely separate systems, and that pollution can be more effectively controlled by these methods.

W69-01844

EUTROPHICATION OF ESTUARINE AREAS BY RAIN WATER,

R. J. Reimold, and F. C. Daiber.

Chesapeake Sci, Vol 8, pp 132-133, 1967.

Descriptors: *Chemical analysis, Rain, Storm runoff, *Estuaries, *Eutrophication, Water quality.

Identifiers: *Atlantic Coast (United States).

Tabulated and graphical results are given of analyses of total phosphorus in rain water at Lewes, Del., from February 1966 to January 1967; the mean concentrations, per litre, were 4.9 microgram-atom in winter and spring, 150 microgram-atom in summer, and 8.1 microgram-atom in autumn and winter. Possible causes of the sudden increase after April are discussed, and it is suggested that this is the reason for the unusual phosphorus cycles found in bay waters and marshes along the east coast of U.S.A., providing an extra source of nutrient during spring and summer when productivity tends to be higher.

W69-01849

HOW COMBINED SEWERS AFFECT WATER POLLUTION. PT 1,

Harold Romer, and Lester Klashman.

Pub Works, Vol 94, p 100, March 1963.

Descriptors: *Water pollution, Sewage treatment, *Design, Discharge (Water).

Identifiers: *Combined sewers, *Urban drainage, Capacity.

This article on studies of pollution of combined sewers discusses results of a questionnaire survey of 148 cities, 80 of which replied (50,000-2,100,000 population). The 11 questions deal with characteristics of combined sewage, combined sewer and treatment plant capacities and design, combined sewage treatment practices, and effects of combined sewage discharges on quality of receiving waters.

W69-01850

HOW COMBINED SEWERS AFFECT WATER POLLUTION. PT 2,

Harold Romer, and Lester M. Klashman.

Pub Works, Vol 94, p 88, April 1963.

Descriptors: *Water pollution.

Identifiers: *Combined sewers, *United States, *Great Britain.

This concluding report on the pollution problems created by combined sewer discharges to waterways during overload periods, cites results of specific studies in the United States and England.

W69-01851

THE INFLUENCE OF COMBINED SEWERS ON POLLUTION CONTROL,

H. Romer, and L. M. Klashman.

Pub Works, Vol 92, No 10, p 129, 1961.

Descriptors: *Water pollution, *Overflow, Design, Surface runoff, *Storm runoff.

Identifiers: *Combined sewers, *Suspended solids, *United States, *Great Britain, *Storage tanks.

In discussing the polluting effects of overflows from combined sewers, the authors review American

and British practice concerning the use of storm-water tanks and summarize British recommendations for the design and operation of combined sewerage systems. Data are given to illustrate the effect of storms on the concentration of suspended solids in storm-water sewage, and the results of studies on quality of surface run-off are reviewed. The use of storm-water tanks in America is being reconsidered.

W69-01852

ENVIRONMENTAL EFFECTS OF HIGHWAYS,

For primary bibliographic entry see Field 04C.

For abstract, see .

W69-01854

YEATES V MILLSAPS (OIL POLLUTION).

110 So 2d 369-372 (Miss 1959).

Descriptors: Remedies, Metal pipes, Pipelines, *Damages, Burning, *Mississippi, Cattle, Judicial decisions, *Oily water, Legal aspects, *Water pollution, Pollutants, Oil.

Identifiers: Res ipsa loquitur, Punitive damages.

Plaintiff sued for damages to his land and cattle resulting from a break in defendant's oil pipeline. Defendant had constructed a pipeline near plaintiff's land in 1954. In 1957 a break occurred in the pipeline, allowing oil to spill into a stream which meandered across plaintiff's land. In an effort to remedy the situation, defendant attempted to burn off the oil, thereby damaging the land. In addition, several of plaintiff's cows were killed or injured as a result of drinking oily water. The lower court applied the doctrine of res ipsa loquitur and submitted the issue of punitive damages to the jury with regard to defendant's efforts to burn the oil. Plaintiff recovered \$7500. This court held that the res ipsa loquitur doctrine was applicable, and whether defendant had overcome the presumption of negligence was a jury question. The judgment was reversed and remanded, however, since the issue of punitive damages was unwarranted and the court was unable to say that the verdict rendered represented only actual damages. (Kahle-Fla)

W69-01946

AMERICAN CYANAMID CO. V SPARTO (INDUSTRIAL POLLUTION).

267 F 2d 425 (5th Cir 1959).

Descriptors: *Texas, Judicial decisions, Easements, Water rights, Competing uses, *Irrigation water, Riparian waters, Water pollution, Agricultural watersheds, *Industrial wastes, Reasonable use, Chemical wastes, Inorganic compounds, Sodium sulfate, Ammonium compounds, *Riparian rights.

Plaintiffs' land is bounded by a river which is used to irrigate their truck farm. Defendant's upstream chemical plant empties large quantities of process water into the stream. The plaintiffs recovered damages for injury to their crops and land on the grounds of nuisance and negligence for the wrongful pollution of the river by the defendants. It is not a defense that part of the water diverted by plaintiffs was used for non-riparian land because only a lower riparian owner can assert this. An easement along the river granted by plaintiffs to a water control and improvement district, which stated that plaintiffs expected to continue to use the land for farming, did not divest them of such rights and possession to the land as to sever and deprive the rest of the land of its riparian character. (Molica-Fla)

W69-01962

NUISANCES: MANUFACTURING PLANT NOT A NUISANCE AFTER OPERATING FOR ONE YEAR; DAMAGES ON ACCOUNT OF POLLUTION OR OVERFLOW OF STREAM.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01967

THE BIOTIC RELATIONSHIPS WITHIN WATER BLOOMS,

Wisconsin Univ., Madison. Hydraulic and Sanitary Lab.

George P. Fitzgerald.

D F Jackson, Algae and Man, Plenum Press, New York, pp 300-306, 1964. 7 p, 41 ref.

Descriptors: *Eutrophication, Succession, Water quality, Algal control, Algicides, Dominant organisms, Grazing, Water pollution effects, Diatoms, Chlorophyta, Cyanophyta, Nuisance algae, Wisconsin, Nutrients, Indicator species, Euglena, Chlamydomonas.

Identifiers: *Blooms, *Biotic factors, Species diversity, Lake Waubesa, Lyngbya, Microcystis, Aphaniotomenon, Anabaena, Melosira, Ceratium, Oscillatoria, Eudorina.

Algal successions, in which nearly unispecific populations of algae alternate with more highly diversified assemblages of species, are characteristic of more natural aquatic environments as well of impoundments, such as sewage stabilization ponds, with no lack of the usually considered nutrients. The usual sequence of species, especially in eutrophic environments, consists of a vernal bloom of diatoms, an early summer growth of green algae, and a late summer bloom of cyanophytes (blue-green algae). After treatment of a water bloom with algicides to alleviate nuisance conditions, the rapid replacement of dominant algal species by others emphasizes that factors which influence dominance may be very subtle. High pollutant loads from sewage sources not only increase algal growth, but may also influence species composition and algal succession. Evidence suggests that secondary effluents may act to suppress succession and reinforce a reduction in species diversity longer than would normally be expected. Since nutrient status of an aquatic environment does not always explain the composition of a bloom, one must often consider the effects of biotic factors such as grazing by the fauna, activities of bacteria and fungi, and the excretion of biologically active compounds by the algae themselves. (Wis)

W69-01977

AN INTRODUCTION TO THE IDENTIFICATION OF CHIRONomid LARVAE,

Federal Water Pollution Control Admin., Div of Pollution Surveillance, Cincinnati, Ohio.

William T. Mason, Jr.

Processed Rept Mar 1968.

Descriptors: *Midges, *Systematics, Indicator organisms, Macroinvertebrates, Water pollution effects.

Identifiers: Keys, Photographs, Chironomidae, Head capsule.

Author presents a taxonomic discussion of common species of chironomid larvae, organisms of importance as indicators of polluted water conditions. Taxonomic keys are included for five subfamilies and for 55 common genera and sub-genera of the family, Chironomidae (midges). The report incorporates photomicrographs which illustrate important systematic characteristics of the following subfamilies:

Tanypodinae, Podonominae, Chironominae, Diamesinae and Orthocladiinae; and for the following genera: Tanypus (2 spp), Ablabesmyia, Procladius, Anatopnia, Coelotanypus, Chironomus, C (Einfeldia), C (Kiefferius), C (Dicrotendipes) (2 spp), C (Cryptochironomus) (4 spp), C (Endochironomus), C (Tribelos), C (Xenochironomus) (2 spp), Goeldichironomus, Glyptotendipes (2 spp), Pseudochironomus, Polypedilum, Paralauterborniella (2 spp), Stenochironomus (3 spp), Stictochironomus, Microtendipes, Tanytarsus, Zavrelia, Micropsectra, Diamesa (2 spp), Prodiamesa (2 spp), Orthocladius (2 spp), Trichocladus, Nanocladius (2 spp), Smittia, Brilla (2 spp), Cardiocladus, Psectrocladius (3 spp), Metriocnemus (2 spp), Diplocladius, Cricotopus (2 spp), and Corynoneura. (Wis)

W69-01978

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

5D. Waste Treatment Processes

FLUSHING OF SEWER NETWORKS: AUTOMATIC DISCHARGE DEVICE,

For primary bibliographic entry see Field 08C.
For abstract, see .
W69-01676

AUTOMATIC CONTROL OF PUMPING INSTALLATIONS,

For primary bibliographic entry see Field 08C.
For abstract, see .
W69-01680

SKIPTON-SILSDEN SEWERAGE FINISHED AHEAD OF SCHEDULE.

For primary bibliographic entry see Field 08A.
For abstract, see .
W69-01684

NEWTHORPE, NOTTS., SEWAGE DISPOSAL WORKS.

For primary bibliographic entry see Field 08A.
For abstract, see .
W69-01685

RELIEVING OVERLOAD ON TAMWORTH SEWAGE WORKS.

Survr Munic Cty Engr, Vol 129, No 3905, p 59, 1967.

Descriptors: *Overflow, Storm runoff, Irrigation, Sewage lagoons.

At Tamworth, Staffs., as in interim measure until new works are constructed, effluents from the filters and sedimentation tanks, as well as storm-sewage overflows, are collected in a 150,000-gal lagoon and distributed on to 44 acres of grassland by spray irrigation. The irrigated area is divided into 3 plots, and an 8-week resting period is allowed for each plot.
W69-01686

PVC SEA OUTFALL IN HUNSTANTON SEWAGE SCHEME.

For primary bibliographic entry see Field 08C.
For abstract, see .
W69-01687

NEW SEWAGE WORKS COMMISSIONED AT LEICESTER.

For primary bibliographic entry see Field 08C.
For abstract, see .
W69-01688

CHICAGO STUDIES PLAN FOR CONTROLLING COMBINED SEWER OVERFLOWS.

Water and Sewage Works, Vol 113, pp 235-36, July 1966.

Descriptors: *Overflows, *Combined sewer, Storm runoff, Treatment.
Identifiers: Storage tanks, Chicago (Ill.).

A plan is outlined to temporarily store storm water from overloaded and overflowing combined sewers in subterranean chambers and to later treat the polluted water before its discharge into waterways.
W69-01689

METHOD OF AND MEANS FOR DEALING WITH STORM-WATER OVERFLOWS IN SEWERS AND LIKE DRAINAGE SYSTEMS.

Longwood Engineering Co., Ltd.

Brit Patent 1,023,311.

Descriptors: *Storm runoff, *Overflow, *Sewers, *Drainage systems, Outlets.
Identifiers: *Suspended solids.

The equipment claimed for dealing with storm-sewage overflows in sewerage and other drainage systems comprises a bay fitted with a trough or channel which has walls of unequal height and a mouth covered with a filter screen which can be cleaned by a rake or rakes rotating in the direction of flow of water through the bay. Under normal conditions of flow, water passes through the bay direct to the foul sewer, but under storm conditions the increased flow causes a build-up of pressure in the bay so that water and floating trash flows over the lower wall of the trough and through the screen to the storm-sewage outlet; trash is swept from the screen by the rake (s) over the higher wall into a trash pit and thence to the foul sewer.
W69-01690

TECHNICAL COMMITTEE ON STORM OVERFLOWS AND THE DISPOSAL OF STORM SEWAGE.

London, Ministry of Housing and Local Government, 1963. 16 pp.

Descriptors: *Storm runoff, *Overflow, *Discharge (Water), Sewage treatment, Design.
Identifiers: *Suspended solids, *Storage tanks.

In the interim report of the Technical Committee which was set up in May 1955 to study and report on storm overflows and the disposal of storm sewage, present practice in the discharge of storm sewage is reviewed; investigations are reported on storm water in 3 drainage areas, Northampton, Brighouse, and Bradford, on the use and operation of storm tanks at sewage works in Tunbridge Wells and Stoke-on-Trent, and on the characteristics of different types of storm overflow; and preliminary conclusions are drawn, particularly with regard to the volumetric setting of storm overflows, the design of overflows to reduce pollution (by providing storage for the first flush of storm sewage and minimizing the amount of floating and heavy-solid polluting material in the overflowing sewage), and the treatment of storm sewage at the sewage works. It is recommended that each sewerage authority should review existing arrangements for the disposal of storm sewage, and the information required in making this assessment is listed.
W69-01691

OPERATING EXPERIENCES AT SWINDON, 1962 - 1967.

W. F. Carmichael.
Meeting of the Institute of Water Pollution Control, Central Southern Branch, March 27, 1968.

Descriptors: Storms, *Automatic control, Sewage treatment, *Equipment, *Overflow, *Storm runoff.
Identifiers: *Storage tanks, Capacity.

The sewage plant, its equipment, and operation are described. In dry weather, only one screen is used. It is operated by a time-clock for five minutes in every fifteen. In time of storms both screens are operated continuously by hand. There are 2 No. detritors with vortex grit washers. Both detritor scrapers, air lift pumps and vortex washers are operated continuously. Three stormwater overflows are controlled by an automatic penstock and standing wave flume. All overflows discharge into a single circular stormwater tank 200 ft. in diameter and of 2 mil. gal. capacity. Effluent from this tank overflows onto 11 acres of underdrained stormwater land.
W69-01696

RAIN DISCHARGE AND SEWAGE SLUDGE.

For primary bibliographic entry see Field 08B.
For abstract, see .
W69-01700

DESIGN, CONSTRUCTION AND OPERATION OF SEWER OUTFALLS IN ESTUARINE AND TIDAL WATERS,

For primary bibliographic entry see Field 08A.
For abstract, see .
W69-01703

MEASUREMENT OF MANNING'S ROUGHNESS COEFFICIENT,

For primary bibliographic entry see Field 08B.
For abstract, see .
W69-01709

SOME HYDRAULIC ASPECTS OF SEWERAGE AND SEWAGE DISPOSAL.

For primary bibliographic entry see Field 08B.
For abstract, see .
W69-01711

WATER POLLUTION R AND D GRANTS.

Environ Sci Technol, Vol 1, No 3, p 189, March 1967.

Descriptors: *Grants, *Water pollution control, Overflow, *Automatic control, *Flow control, Storm runoff.
Identifiers: *Combined sewers, *Storage tanks, *Sewer-within-sewer.

Approximately \$20 million in contracts and grants were awarded in 1966 by the Federal Water Pollution Control Administration. About half the total was for studies of improved methods for dealing with overflows from combined sewers. Nine cities were awarded a total of slightly more than \$8 million to help finance such projects as construction of large detention basins to hold combined sewer overflow prior to treatment, and for installation of automated sewer regulator stations designed to provide better control of combined flows. Contracts of \$1.6 million were awarded to private companies to study such possibilities as building a sewer within a sewer or constructing submerged containers capable of holding combined sewer waste until it can be pumped back to the treatment plant.
W69-01717

SEWER SEPARATION.

For primary bibliographic entry see Field 08A.
For abstract, see .
W69-01719

SEWER WITHIN A SEWER.

For primary bibliographic entry see Field 08A.
For abstract, see .
W69-01720

SEPARATING STORM AND SANITARY SEWERS IN URBAN RENEWAL.

32nd Report by the Committee on Govt Operations, US House of Representatives, House Rept 1648, US Govt Printing Off, Washington, DC, June 23, 1966. 20 p, 2 tab.

Descriptors: *Water pollution, Grants.
Identifiers: *Storm sewers, *Sewer separation, *Combined sewers, Urban drainage.

The need for separating storm and sanitary sewers is discussed, with emphasis on separating such sewers in areas being developed or redeveloped under federal aid. The 1962 Public Health Service Table on number and size of communities served by combined sewer systems is given. A 1964 Public Health Service appraisal of combined sewers is outlined. Demonstration grants to develop measures to control pollution from combined sewers are described. Problems and controversy concerning separation of sewers in the University-Euclid urban renewal project in Cleveland are discussed and other sewer programs are outlined.
W69-01723

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Waste Treatment Processes—Group 5D

DISPOSAL OF MUNICIPAL SEWAGE (WATER POLLUTION CONTROL AND ABATEMENT).

House of Representatives Union Calendar No 90, 89th Cong, 1st Sess, Rep No 204, 1965. 40 pp.

Descriptors: *Water pollution, *Storm runoff, *Overflow.

Identifiers: *Combined sewers.

This is the 12th report of the U.S. Committee on Government Operations and is based on a study made by its Natural Resources and Power Subcommittee to examine whether Government agencies are coping effectively with water pollution problems and to determine possible improvements in techniques for preventing and controlling pollution of rivers and other water resources. The present position and problems of sewage disposal are reviewed in relation to water pollution, including the problems caused by combined sewerage systems and storm-sewage overflows, and recommendations are made for future action by Government departments; comprehensive planning and co-ordination of sewage-treatment facilities for municipal areas; and development of new methods of sewage treatment.

W69-01724

INTERCEPTORS HAVE UNUSUAL DESIGN FEATURES.

W. M. Bailey.

Water and Wastes Eng, Vol 4, No 1, pp 55-7, Jan 1967.

Descriptors: *Design, Sewers, Storm runoff, Sewage treatment.

Identifiers: *Interceptor sewers, *Omaha (Nebr).

Waste collection and treatment installation in Missouri River basin at Omaha, Nebr; project includes 64,700 ft of collecting sewers and plant that gives primary treatment to wastes before discharging them into river; bi-directional sewer operates during low flow periods as gravity sewer flowing in one direction; during time of storm flow, it becomes force main that flows in two directions; another feature is segregated treatment plant that permits low strength and high strength wastes to be treated separately or mixed in any desirable proportion.

W69-01725

MUNICIPAL SEWERAGE.

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01731

RESIDENTIAL USE AND MISUSE OF SANITARY SEWERS,

Grant S. Bell.

J Water Poll Control Fed, Vol 35, Jan 1963.

Descriptors: Sewers, Cities, *Construction, *Quality control.

Identifiers: *Residential sewers.

Experience in Kentucky has already proven that it would have been much easier for the cities to have acted firmly on the matter of overloading of sanitary sewers by residence drainage than to suffer the consequences of leaving private sewers to builders' and owners' methods. Quality control of private sewer construction and regulation of the use of sewers are imperative to a totally successful sanitary sewer system.

W69-01737

SEWER DESIGN-INFILTRATION DETECTION AND CORRECTION,

B. J. Haney.

Louisiana State Univ-Eng Res Station-Bul 83, pp 55-71, 1965.

Descriptors: *Sewers, *Design, Pipes, Construction.

Identifiers: *Sewer infiltration, Leak detection.

Calculation of capacity of sewer system, sizing of pipe, determination of pipe slope, selection of pipe material, and proper installation of pipe as basic steps in design of gravity sewer system.

W69-01744

Identifiers: *Interceptor sewers, *Combined sewers, *Capacity, *St. Louis (Mo).

Preliminary to the sizing of the sewers, pumping stations, and treatment plants of the Metropolitan St. Louis Sewer District's Mississippi River Pollution Abatement Project, it was necessary to adopt a design criterion for the interceptors on the combined sewers. The amount of pollutant load spilled to the river during storm water runoff was computed for interceptors of three different capacities when functioning under rainfall conditions corresponding to those experienced during 1955. Pollution was measured in terms of 'equivalent hours of sewage flow.' It was found that with interceptors having a capacity of 1.0 times peak sewage flow, 3.1% of the total yearly sewage flow would be spilled during storm water runoff. Furthermore, the efficiency of the overall project after primary treatment would be approximately 0.25% less with interceptor capacity of 1.0 times peak sewage flow than with interceptor capacity of 1.25 times peak sewage flow, whereas the increase in cost of the project, using the larger interceptors would have been on the order of \$2,800,000. The smaller size interceptor was adopted.

W69-01798

EFFECTS OF USE ON THE HYDRAULIC RESISTANCE OF DRAINAGE CONDUITS.

For primary bibliographic entry see Field 08B.

For abstract, see .

W69-01752

PROVIDE DRAINAGE BEFORE FLOODS OCCUR.

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01753

PLANNED CITY PLANS TO RE-USE STORM RUNOFF.

For primary bibliographic entry see Field 03C.

For abstract, see .

W69-01759

PROCEEDINGS OF THE THIRTEENTH CONFERENCE OF LOCAL AUTHORITY ENGINEERS, QUEENSLAND, 1962.

For primary bibliographic entry see Field 08A.

For abstract, see .

W69-01764

THIRTEENTH ANNUAL REPORT, 1963-64.

Mersey River Board.

For primary bibliographic entry see Field 05G.

For abstract, see .

W69-01768

MAIN DRAINAGE FOR SKELMERSDALE NEW TOWN.

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01784

ELIMINATION OF MARGINAL POLLUTION-JAMAICA BAY.

Report to Dept of Public Works, New York City. Greeley and Hanse, Engineers, (No date).

Descriptors: *Deterioration, *Water quality, *Overflow, Recreation facilities, *Storm runoff, *Water pollution, Sewage treatment, *Chlorination, Sedimentation, *Estuaries.

Identifiers: *Combined sewers, *Storage tanks, *Jamaica Bay (N. Y.).

This report demonstrates the general relationship between deterioration of beach water quality after heavy rains from overflows of mingled sewage and storm water. Recommendations for specific area corrections are detailed - mainly attempting to develop a system of separate sewers to replace existing and overloaded combined sewers. Recommendations would localize potential pollution from storm water overflows to seven areas where storm water overflow treatment works are suggested. Overflow treatment to consist of large holding basins to capture the overflow, permit sedimentation and chlorination prior to ultimate discharge to Jamaica Bay or pumping to sewage treatment plants.

W69-01792

DESIGN CRITERIA FOR INTERCEPTOR SEWERS FOR ST LOUIS.

Erwin E. Bloss.

ASCE Proc, J. Sanit Eng Div, Vol 92, No SA4, Proc Paper 4877, pp 7-31, Aug 1966.

Descriptors: *Design, Pumping, Sewers, *Water pollution control, *Storm runoff, Overflow, *Construction costs.

STORM WATER FLOW SELECTION METHOD ELIMINATES SILT PROBLEM,

G. Chanin.

Water and Sewage Works, Vol 102, No 8, pp 300-3, July 1955.

Descriptors: *Storm runoff, *Storm drains, Sewage treatment.

Identifiers: *Suspended solids.

New Sewage Treatment Plant in Oakland, California, had disadvantage that large volumes of storm water with fine sand and silt reached it so that sludge collectors were completely covered; to eliminate this, channel was constructed to by-pass storm waters; requirements for test to determine whether sand and silt are present and whether bypass gates should be opened.

W69-01804

POLLUTION CONTROL MEASURES FOR STORMWATERS AND COMBINED SEWER OVERFLOWS,

D. D. Dunbar, and J. G. F. Henry.

J Water Poll Control Fed, Vol 38, No 1, p 9, Jan 1966.

Descriptors: *Water pollution control, *Storm runoff, *Overflow, *Chlorination.

Identifiers: *Combined sewers, *Storm sewers, *Interceptor sewers, Capacity.

Two primary sources of water pollution other than domestic and industrial wastewaters are the discharges from combined sewer overflows and from separate storm sewer systems. Such overflows can contribute objectionable amounts of pollution to receiving waters. Interceptor and wastewater treatment plant capacity in relation to average dry-weather flow shows that the overall efficiency of raw sewage collection is not improved greatly once such capacity reaches 3 x dry-weather flow. Partial separation of stormwater by collecting street runoff in a collection system independent of an existing combined system markedly increases pollution control efficiency of the existing system; this method is about 40 percent as costly as total separation. Volumetric storage sufficient for a storm of 1.2 in/6 hr (30.5 mm/6 hr) can reduce stormwater escaping treatment from 85 to 40 percent. Chlorination of stormwater runoff or of mixtures of stormwater and raw sewage can reduce effectively bacterial concentrations.

W69-01810

KANSAS CITY'S POLLUTION ABATEMENT PROGRAM,

G. J. Hopkins.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

Water Pollut Contr Fed J, Vol 39, No 9, pp 1487-1503, Sept 1967.

Descriptors: *Water pollution control, Sewage sludge, Sewage treatment, *Storm runoff, Pumping, *Overflow.

Identifiers: *Combined sewers, Sewer separation, *Kansas City (Mo.), Missouri River.

Kansas City, Mo., is carrying out a \$75 million program to abate pollution of the Missouri River and its tributaries in the area. The program is financed by revenue bonds supported by a sewer service charge. The plan is geared to joint use of facilities by Kansas City and the numerous adjacent municipalities. Primary treatment of all wastewater is now in effect. The facilities now completed include four treatment plants and a number of pump stations, force mains, and interceptor sewers. Sewers will be extended to presently undeveloped areas. Unusual features include a sewer river crossing, use of an abandoned water main as a sewer force main, and pumping of sludge 7 miles (11.3 km) for treatment at a central facility. Waste treatment is unlikely to provide a total solution to the Missouri River's water quality problems. There is no demonstrable need or economic justification for stormwater separation for the Missouri River. Quality of stormwater overflows may compare favorably with that of the receiving water. These overflows occur less than four percent of the time and their pollution significance has not been demonstrated.

W69-01823

OIL-SEPARATOR TANKS FOR MOTORWAYS IN THE RUHR VALLEY.

K. R. Imhoff.

Gas Wasserfach, Vol 108, pp 43-45, 1967.

Descriptors: *Highways, *Runoff, *Water pollution, *Storm runoff.

Identifiers: *Storm sewers, Capacity, *Oil pollution.

In connexion with the prevention of pollution by oil, deposited on motorways by the increasing number of oil tankers, and washed-off into the receiving waters by rainfall, detailed studies were carried out by the Ruhrverband on the Westhofer motorway between Remscheid and Kamen. Oil-separator tanks have been installed along sections of the new motorway before the storm sewage enters the receiving water to protect numerous water works in the lower and middle Ruhr, which serve a large community. Based on the specifications DIN 4040 and 4043 of the Ruhrverband, these tanks are constructed for a surface loading of 12 m per hour and a retention period of 10 min; the calculation of the run-off is based on 100 litre per second per hectare. The run-off values and time factor are adjusted to local conditions. Successful operational results showed that 6 months after installation a 4-cm deposit of sludge and 1.2-m (to the third power) of sand had collected from each influent and these were easily withdrawn by suction pumps. Tabulated data are included and a map shows the areas selected for present and future positions of separator tanks.

W69-01827

NATION'S CAPITAL ENLARGES ITS SEWERAGE SYSTEM,

C. Frank Johnson.

Civ Eng, Vol 28, No 6, 1958.

Descriptors: *Water pollution, *Overflow, Recreational facilities, *Pumping, *Storm runoff.

Identifiers: *Interceptor sewers, *Combined sewers, *Washington, D.C., *Sewer separation.

Pollution from combined sewer overflows is prohibiting the use of Potomac and Anacostia Rivers and Rock Creek in Washington, D.C. for many recreational uses. A \$151,000,000 improvement program is recommended, mostly for relief sewers and pumping stations. Some of the interceptors are so inadequate that they overflow even in

dry weather. The separation of all sewers was considered but concluded to be too costly. Alternate plan is to construct large enough relief sewers that overflows into Rock Creek will have a dilution factor of 200 and Upper Potomac 30 before overflowing. This represents a storm of 2 year frequency.

W69-01829

CHEMICAL CONTROL OF WATER QUALITY IN A TIDAL BASIN,

M. Lang.

J Water Poll Control Fed, Vol 38, pp 1410-1418, 1966.

Descriptors: *Storm runoff, *Overflow, *Water pollution, Sewage treatment.

Identifiers: *Intercepting sewers, Bergen Basin (N.Y.).

Bergen basin, a small arm of Jamaica Bay, N.Y., is a tidal basin with no surface-water tributaries, but it receives discharges of storm sewage when the capacity of the nearby Jamaica sewage works is exceeded during storms, and at times in hot weather there has been slight odour nuisance. In 1963, when alterations were being made to the sewage works, all the plant effluent was discharged to the basin for 2 weeks; at this time the influent sewage was septic, having been stored in the intercepting sewers for some months while the alterations were in progress, and this caused severe pollution of the basin with very strong evolution of hydrogen sulphide. In an attempt to improve conditions, bulk sodium nitrate was added to the basin to create aerobic conditions in the bottom deposits and sodium hypochlorite solution was also added to oxidize the hydrogen sulphide in the water; these measures proved effective, and subsequently addition of hypochlorite was discontinued, but sodium nitrate is still being added to the basin.

W69-01832

ADMINISTRATIVE AND FINANCIAL ASPECTS OF OPERATING A METROPOLITAN SEWER DISTRICT,

Metropolitan St Louis Sewer Dist, St Louis, Mo.

P. F. Mattei, and C. B. Kaiser.

Water Pollut Control Fed J, Vol 39, No 4, pp 501-517, April 1967.

Descriptors: Watersheds, *Storm runoff, *Water pollution control, *Construction costs, Outlets, Drainage systems, Sewage treatment.

Identifiers: *Urban drainage, *Interceptor sewers, *St. Louis (Mo.).

The organization and financing of the 12 yr. old Metropolitan St. Louis Sewer District are described. A watershed by watershed study was made to determine the stormwater problem and results have shown what the district needs but the more than a hundred million dollar overall cost necessitates a piecemeal approval, dealing with the worst problems through subdistrict programs and self-help programs. To relieve pollution of the Mississippi by sewage, construction of an interceptor sewer picking up all of the wastewater outlets along the river was begun as well as construction of two large primary treatment plants. Problems and possible solutions for financing the needed stormwater facilities are discussed.

W69-01837

THE MINNEAPOLIS-SAINT PAUL SANITARY DISTRICT - OPERATION AND EXPANSION,

K. L. Mick.

Water Pollut Control Fed J, Vol 39, No 10, pp 1684-1700, Oct 1967. 1 fig, 3 tab, 6 ref.

Descriptors: *Sewage treatment, Grants, *Overflow, Construction costs, Water pollution.

Identifiers: *Interceptor sewers, *Storm sewers, *Combined sewers, Minneapolis-St. Paul (Minn.).

Results of a 1956-60 study of the Minneapolis-St. Paul Sanitary District called for central treatment

of wastewater at the existing plant, plant expansion, and interceptor sewer construction. Estimated costs are given. Expansion of the existing primary plant is discussed. A study on the combined sanitary and storm sewer problem was also included. The study recommended that a system of power-operated gates be installed on 15 key regulators, with gate positions and levels in major sewers telemetered to a central control point. These 15 diversion points accounted for about 80 percent of the overflow to the river in 1960. In 1966 the District received a Federal demonstration grant offer of 50 percent for a sewer regulator project estimated to cost \$1,741,500. This work will include an evaluation of the effect on river conditions. A supervisory control system will promote maximum utilization of the interceptor sewer and treatment facilities, taking into account rainfall distribution in the area and other factors. It will provide a new technique of instantaneous observation and control of interceptor system performance to minimize overflows to the river.

W69-01838

DISCHARGE OF RAIN WATER FROM URBAN SEWERS INTO STREAMS,

M. Negulescu, and I. Rabinovici.

Hidrotehnica, Vol 9, pp 205-209, 1964.

Descriptors: *Storm runoff, *Water pollution, Discharge (Water), *Water pollution control.

Identifiers: *Urban drainage, *Combined sewers, *Storage tanks.

It is indicated that rain water discharged from combined or separate sewers in urban areas can have as great or even double the polluting effect of domestic sewage and can damage the receiving stream particularly if the areas are industrial. Storage reservoirs along the sewerage system or as part of the treatment plant are suggested as a means of protecting streams.

W69-01841

THE BATTLE TO SAVE LAKE MICHIGAN,

H. W. Poston.

Civ Eng, Vol 37, No 12, pp 40-43, Dec 1967.

Descriptors: Sewage treatment, *Overflow, *Water pollution control, *Flow measurement, Storm runoff.

Identifiers: *Combined sewers, *Interceptor sewers, *Storage tanks, *Chicago (Ill), *Lake Michigan.

As a result of an enforcement conference called by the Federal Water Pollution Control Administration, Indiana communities whose wastes dump into Lake Michigan have already added secondary treatment facilities; detention facilities and combined sanitary-storm sewers are to be built to prevent overflow. Chicago is attempting to solve this problem by retaining storm water overflows in underground interceptor sewers of large diameter 250 ft. deep, where the water can be stored for future treatment. Milwaukee is establishing automatic monitors along the Milwaukee River to measure the average yearly flows and peak flows of the sewer system as affected by rainfall in an attempt to locate critical points where control facilities should be installed. In addition, a 3.8 million gallon underground detention tank will be constructed to trap storm overflows, which will be retained for subsequent treatment.

W69-01845

STRATFORD-UPON-AVON SEWAGE WORKS.

Wat Poll Control, London, Vol 66, pp 268-269, 1967.

Descriptors: *Storm runoff, Treatment, Land use.

A description is given of the new Milcote sewage works of Stratford, Warwickshire, which provide complete treatment for a dry-weather flow of 1.55

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m.g.d. by biological filtration with recirculation of effluent. Sludge is digested and disposed of on land; drying beds are available for dewatering excess sludge. About 1 acre of underdrained land is also available for treatment of storm sewage or for further treatment of final effluent if necessary.

W69-01855

WINDSOR STARTS POLLUTION CLEAN-UP.
Wat Poll Control, Ontario, Vol 104, No 5, pp 23-27, 1966.

Descriptors: *Storm runoff, Sewage effluent, Chlorination.

Treatment facilities provided at the Little River Sewage Works at Riverside, Windsor, Ontario, are outlined and illustrated. The plant, which serves Riverside and Sandwich East, has a capacity of 4 m.g.d., with space available for future expansion; it provides complete treatment by the activated-sludge process. Excess storm sewage and final effluent are chlorinated before discharge to the Little River, while crude primary and excess activated sludge are conditioned with ferric chloride and lime, dewatered on an automatically-controlled vacuum filter, and used as land-fill.

W69-01856

CITY OF MILWAUKEE.
Water Wastes Eng, p 118, (n.d.).

Descriptors: *Overflow, *Storm runoff, *Chlorination.

Identifiers: *Combined sewers, *Storage tanks, Milwaukee (Wis).

Milwaukee is constructing an underground concrete tank to catch rainstorm overflow from the combined sewer system. The demonstration tank will be 170 ft. long, 130 ft. wide and 30 ft. deep and will hold 3,900,000 gal. The tank will be designed to catch the run-off, purify it with chlorine or hold it until the storm ends. Then it will gradually drain the run-off back into the combined sewer system, which flows to the sewage treatment plant.

W69-01857

TREATMENT OF OVERFLOWS FROM COMBINED SEWERAGE SYSTEMS BY USE OF STORM WATER STORAGE AND CHLORINATION.

New Hampshire Water Pollution Commission Staff Report No 40, March 1959.

Descriptors: *Overflow, *Storm runoff, *Chlorination, Water quality, Recreation facilities.

Identifiers: *Combined sewers, *Storage tanks.

A study of a procedure to treat enough of the storm water overflow from an adequate combined system to achieve B-1 quality in a receiving water nearly 100% of the summer bathing season. Assumptions and procedure are detailed.

W69-01858

BACTERIAL REDUCTIONS IN THE CHLORINATION OF SEWAGE--EFFECT OF AGITATION.

New Hampshire Water Pollution Commission Report No 3, Staff Report No 42, March 1960.

Descriptors: *Chlorination, *Sewage effluents, *Coliforms, Sewage treatment.

Report covers three studies on the bacteriologically acceptability of effluents which have been chlorinated with doses of 30 to 40 ppm with gentle stirring after comminution. Study I: Determined if there exists a practical level of chlorination of raw sewage that 99 percent of time with 15 minute chlorine contact and without settling can be relied upon to produce ultimate coliform bacterial counts

in the effluent not to exceed 240/100 ml even when such effluent is subsequently subjected to rigorous breakup of particulate matter. Finding -- At practical chlorine dose levels of 40 ppm or less simple chlorination of unsettled raw sewage cannot be relied upon.

W69-01859

SYSTEM STUDY, DESIGN, AND EVALUATION OF THE LOCAL STORAGE, TREATMENT AND REFUSE OF STORM WATER.
Hittman Associates, Inc.

Final Report - Contract No 14-12-20 with the Federal Water Pollution Control Administration, August 1967, 5 p.

Descriptors: *Storm runoff, *Treatment, *Water reuse, Sampling, Computer programs.

Identifiers: Columbia (Md), *Storage tanks.

An \$850,000 two-year program is suggested for the collection of stormwater runoff in three small storage basins and pretreatment units in the new city development of Columbia, Md., the treatment of this runoff to remove pollutants, and its further treatment for potable reuse. A packaged water treatment plant would be used to determine the technical and economic feasibility of such treatment. Gaging and sampling stations, and a connection to the public water system, are included in the plan. A computer-generated cost-benefit analysis was used to determine such facets as optional size of storage reservoirs and optional system configuration. A 'Study of Reuse of Storm Water', by Whitman, Requardt and Associates, indicating various consumptive (e.g., toilet flushing) and non-consumptive (e.g., fire protection) re-uses, forms part of the Appendix.

W69-01860

PROTECTING THE POTOMAC AT WASHINGTON.
D. V. Auld.

J Water Poll Control Fed, Vol 37, pp 275-291, 1965.

Descriptors: *Water pollution control, Water quality, *Chlorination, *Storm runoff, Sewers, Estuaries.

Identifiers: *Combined sewers, *Sewer separation, *Potomac River, *Storage tanks.

To reduce pollution of the Potomac river in the Washington metropolitan area, several counties, cities and towns have formed an informal organization that has adopted water quality objectives for 63 miles of the river, agreed that there should be neither treated nor untreated waste discharges for some 38 miles above the head of tide-water, and established a Regional Sanitary Advisory Board which has developed a comprehensive plan for sewage disposal. As part of this regional effort, the District of Columbia is provided sewerage facilities for much of the surrounding territory, including the new Dulles International Airport in Virginia. The sewage works have been expanded to provide secondary treatment by the highrate activated-sludge process, and it is planned to provide preliminary tanks and chlorination facilities for storm flows in excess of those receiving complete treatment. The new sewerage facilities are on the separate system, and work has already begun on converting the older parts of the system from the combined to the separate type.

W69-01861

CHICAGO MSD PROGRESS REPORT ON CHLORINATION,
Metropolitan Sanitary District of Greater Chicago, Chicago, Ill.

Vinton Bacon.

Water Sewage Works, pp 350-351, Sept. 1967.

Descriptors: *Chlorination, Sewage treatment, *Construction costs.

Identifiers: Capacity, *Chicago (Ill).

It has been possible to complete chlorination facilities for the North Side Sewage Treatment Works 1 1/2 years ahead of schedule, by utilizing the effluent conduit and the North Shore Channel for the contact basins, thus obviating long and costly construction. The cost of this project was a dramatically low \$162 per mgd capacity, in contrast to \$8,380 per mgd capacity for other plants. At the rated capacity of 300 mgd, a 9-minute detention is achieved in the effluent conduit. Chlorine dosages of 1.8 mg/l are being used for initial operations.

W69-01862

CHICAGO METRO SANITARY DISTRICT MAKES NO LITTLE PLANS,
V. W. Bacon, and F. E. Dalton.
Pub Works, Vol 97, No 11, pp 66-70, 140, 142, 1966.

Descriptors: *Water pollution control, Sewage sludge, *Storm runoff, *Overflow, *Chlorination, Sewage treatment.

Identifiers: *Combined sewers, *Storage tanks, *Chicago (Ill.), Sewer separation, *Rapid filter.

Because of increased demands on treatment plants and higher environmental standards, various solutions are considered for easing the pollution problem in the Chicago area, including the use of long transmission lines to discharge digested sludge to large areas of marginal agricultural soil and to coal strip mines. Also considered is the underground storage of contaminated storm-sewage overflows from combined sewers; storage would be in a system of tunnels and large chambers excavated in solid rock deep under the city, and the sewage would be pumped to the surface for treatment after storms, a more economical solution than the provision of separate sewers. As a temporary solution the District is experimenting with the chlorination of storm-sewage overflows. A brief report is given on the need for tertiary treatment; a 2-m.g.d. plant will be installed as an experiment at the District's Hanover Park plant to provide tertiary treatment by coagulation, chlorination, rapid sand filtration, and final aeration.

W69-01863

THE ST JOSEPH, MISSOURI WATER POLLUTION CONTROL PROGRAM,
R. L. Brown, and W. R. Condon.
J Water Poll Control Fed, Vol 39, pp 1374-1380, 1967.

Descriptors: *Water pollution control, *Storm runoff, *Sewage treatment, Sedimentation, Sewage sludge, Maintenance.

Identifiers: *Combined sewers, St. Joseph (Mo).

To reduce pollution of the Missouri river, a sewage works is being constructed at St. Joseph, Mo., to provide treatment for combined sewage and storm water by aerated grit removal, sedimentation, and sludge digestion. Digested sludge will be dewatered by vacuum filtration, but provision has also been made for dewatering on sand beds or for disposal of liquid sludge on farmland. The operation and maintenance of the sewerage system are described.

W69-01866

CHLORINATION OF MIXED SEWAGE AND STORM WATER,

T. R. Camp.

ASCE Proc, J Sanit Eng Div, Vol 87, No SA 1, 1961.

Descriptors: *Chlorination, *Storm runoff, Outlets, Sewage treatment, *Biochemical oxygen demand, *Pathogenic bacteria.

Identifiers: *Suspended solids, *Combined sewers.

The author deplores the present tendency to concentrate on primary treatment of sewage to reduce the B.O.D. and the concentration of suspended solids, while overlooking the need for destruction of pathogenic bacteria and viruses. In older communities with combined sewerage systems about 3

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per cent of the sanitary sewage is discharged with storm water through storm-water outfalls, and this should also receive treatment to remove bacteria. The author describes experiments carried out on the chlorination of sewage alone and in admixture with storm water. The results indicate that such treatment is effective. The amount of chlorine required for disinfection of storm water would be about 50 per cent more than the amount required for treatment of the dry weather flow alone.

W69-01867

STORM-WATER TANKS IN THE COMBINED SEWERAGE SYSTEM OF BERLIN, A. Cohrs. Gas Wasserfach, Vol 103, pp 947-952, 1962.

Descriptors: *Storm runoff, *Design, *Construction, Sewage treatment, Cities.

Identifiers: *Storage tanks, Berlin (Germany).

An illustrated description of the design and construction of storm-water tanks in the sewerage system of Berlin.

W69-01869

WEST BRIDGFIELD'S 1897 SEWAGE WORKS WILL BE MODERNIZED BY 1964,

R. Dewsbury.

Munic Eng, Vol 139, p 1277, 1962.

Descriptors: Sewage treatment, *Storm runoff, Pumping.

Identifiers: *Storage tanks.

Mining subsidence prevented the building of a new sewage plant for West Bridgford, and it was decided to convey all sewage to the Nottingham treatment plant. The district, which has a population of 3500, has been divided into five new drainage areas. All sewage will be collected at a new main pumping station, and storm-water tanks and an outfall to a watercourse will be provided for high flows.

W69-01870

BIOLOGICAL FILTRATION USING A PLASTIC FILTER MEDIUM,

Water Pollution Research Laboratory, Stevenage, Gt Brit.

G. E. Eden, G. A. Truesdale, and H. T. Mann.
Inst Sewage Purif. J and Proc, Pt 6, pp 562-574, 1966. 3 tab, 7 fig, 7 ref.

Descriptors: *Sewage treatment, Biochemical oxygen demand, Sewage effluent.

Identifiers: *Suspended solids.

Experiments in the use of the Dow 'Surpac' fabricated plastic medium for use in percolating filters are described. The material was tested in comparison with 2 1/2 in. rounded gravel, and with granite and at various rates of sewage application and BOD loads. It seems clear that effluents of high quality cannot be expected from media of this type; their advantage seems to lie, rather in their ability to accommodate large volumes of film and to permit the rapid passage of suspended matter, as in the treatment of unsettled liquids.

W69-01871

SEWAGE TREATMENT. VII. SEPARATION AND TREATMENT OF STORM WATER,

L. B. Escritt.

Contractor's Rec, Vol 59, No 32, p 11, 1948.

Descriptors: Sewage treatment, *Storm runoff, *Flow control.

Identifiers: *Storage tanks.

Methods of dealing with storm water flow at sewage works with and without storm tanks are described. The design of orifices for control of the flow to the sewage works is discussed.

W69-01872

SEWAGE TREATMENT PROCESSES. IV. STORM TANKS,

L. B. Escritt.

The Water and Waste Treatment J, Vol 6, pp 407-8, Sept-Oct 1957.

Descriptors: *Storm runoff, Pumping, *Flow control, Sewage treatment.

Identifiers: *Storage tanks, *Capacity.

This article deals with the reason for using storm tanks to serve as storage or holding tanks to prevent the discharge of excessive storm infiltration to the treatment works. Points discussed are purpose of storm tanks, theoretical capacity of tanks, storm water separation, storm tank details, and balancing flows from pumping stations.

W69-01873

SEWAGE TREATMENT AT SLOUGH,

John Finch.

Effluent Water Treat J, Vol 4, pp 275-77, June 1964.

Descriptors: *Storm runoff, Sewage treatment.

Identifiers: *Storage tanks.

Sewage treatment works serving the Borough of Slough, next to the lower terraces of the Thames River, are discussed with special emphasis on the design features necessitated by flat topography, high ground water table, and location of the plant site only a few feet above river level. The entire flow is pumped before entry into the plant. The flow is subject to comminution and grit removal. Excessive storm flows are bypassed to storage tanks to be returned to sewage flows when conditions are favorable. Flow is then divided. The high-level plant consists of primary settlement in a circular flow tank, high intensity aeration, effluent treatment by trickling filters, final settling, and disposal to the Thames River. The low-level plant consists of horizontal-flow, rectangular tanks without mechanical sludge removal equipment. Low-level plant flow is divided between standard rate filters and aeration units. When plant modification is complete, the entire flow will be aerated, filtered, and settled. Humus sludge and surplus activated sludge are pumped to primary tanks to be settled out with primary sludge. Sludge is thickened and digested.

W69-01874

COMPLETION OF FURTHER STAGE IN GRANGEMOUTH DRAINAGE SCHEME,

J. M. Fraser.

Consult Engr, Vol 23, pp 550-553, 1963.

Descriptors: *Sewage treatment, Equipment, Discharge (Water).

Identifiers: *Combined sewers.

The new combined sewerage system to serve the Bowhouse area of Grangemouth, Stirlingshire, is described. At the pumping station, flows up to 6 times dry-weather flow are comminuted before discharge to the Forth estuary 270 yards offshore; this volume of sewage will later be treated at a new sewage works which is to be constructed. Flows in excess of 6 times dry-weather flow are screened and discharged to the river Avon.

W69-01875

THE EFFICIENCY OF CONVENTIONAL SEWAGE PURIFICATION WORKS, STABILIZATION PONDS, AND MATURATION PONDS WITH RESPECT TO THE SURVIVAL OF PATHOGENIC BACTERIA AND INDICATOR ORGANISMS,

O. J. Coetzee, and N. Fourie.

Proceedings, Resolutions, and Papers of the Conference on the Problems Associated with the Purification, Discharge and Re-Use of Municipal and Industrial Effluents, Pretoria, 1964, pp 93-108.

Descriptors: Sewage treatment, *Sewage effluent, *Storm runoff, Sewage lagoons, *Bioindicators, *Pathogenic bacteria.

Identifiers: *Bacteriological sampling.

Tabulated and graphical results are presented from studies on the removal of Esch. coli, Salmonella typhi, Pseudomonas aeruginosa, and clostridium perfringens at various stages of the conventional sewage treatment process (using double filtration) and in lagoons. Neither system gave a safe effluent, but the lagoons are considered safer since there were no increases in any species of bacteria at any time. Lagoons have the additional advantage that all crude sewage, even during storms, receives treatment and none is by-passed. Results indicate that Esch. coli is not an infallible indicator for the presence of pathogenic organisms; a new indicator organism is needed and it is considered that an indicator fungus would have certain advantages which are listed.

W69-01876

AUTOMATED PUMPING STATIONS FOR OUR NATION'S CAPITAL,

E. E. Halmos.

Water Sewage Works, Vol 114, No 9, pp 319-321, Sept 1967.

Descriptors: *Automatic control, Sewage treatment, *Storm runoff, Pumping, Sewers.

Identifiers: *Storm sewers, *Interceptor sewers, *Urban drainage, Sewer separation, *Washington, D.C.

Two new installations are described. The Potomac Station is an automated plant which handles sewage and stormwater from the sewage interceptor line serving Dulles Airport and other Virginia and Maryland communities. The 'O' St. Station handles sewage and stormwater from a redevelopment area where 100 acres of slum is being replaced. Both units will eventually bypass the main station which has 4 sanitary pumps operating at near their capacity of 280 mgd; the six stormwater pumps can handle up to 480 mgd. The city has totally separated storm and sanitary sewers. The pumps and the operation procedures of the station are described.

W69-01878

WESTON-SUPER-MARE'S NEW DRAINAGE SCHEME,

J. R. F. Hewish.

J Instn Munic Engrs, Vol 93, pp 30-32, 1966.

Descriptors: *Sewage treatment, Pumping, *Storm runoff.

The new drainage scheme of Weston-super-Mare, Somerset, is described in more detail, with particular reference to the dry-weather-flow and stormwater pumps, the system of power supply which involves electric power from the mains, two diesel alternators to reduce the maximal demand from the mains, and an emergency generator, and the system of alarm to warn of the danger of flooding. In continued dry weather the flow to the station is 400,000 ft³ (3) per day or 57 gal per head per day.

W69-01879

PROVIDING PRIMARY TREATMENT FOR STORM SEWAGE OVERFLOWS,

W. C. Hirn.

Wastes Eng, Vol 33, 1962.

Descriptors: *Storm runoff, *Overflow, *Sewage treatment, Sewage sludge, Sedimentation.

Identifiers: *Interceptor sewers, *Urban drainage, *Combined sewers.

The Milk River Drain project which serves Grosse Pointe Woods and Harper Woods to the northeast of Detroit, Mich., is described. Sewage is discharged to the Grosse Pointe interceptor which discharges to Detroit municipal sewers; combined flows in excess of 8000 gal per min are diverted to a sedimentation-skimming tank to remove sludge before discharge to Lake St. Clair. Settled sludge is periodically flushed from the sedimentation tank

and discharged to the Grosse Pointe interceptor for treatment at the Detroit sewage-treatment plant.
W69-01880

DESIGN AND OPERATING EXPERIENCES AT THE NEW WORSLEY U D C SEWAGE WORKS,
J. M. A. Hope.
J Proc Inst Sew Purif, pp 455-458, 1965.

Descriptors: *Sewage treatment, *Storm runoff, Overflow.

The new sewage works serving Worsley, Walkden, and Little Hulton, Lancs., are designed to treat 1 m.g.d. of mainly domestic sewage by the activated-sludge process with Simplex aeration cones; there are no storm overflows on the sewers near the works and full treatment is provided for flows up to 4 times dry-weather flow and the remainder receives primary treatment. Experiences in the initial operation of the plant are outlined.
W69-01881

EFFECT OF STORAGE AND SKIMMING ON COMBINED SEWAGE OVERFLOWS,
Hubbell, Roth and Clark, Inc., Bloomfield Hills, Mich.

George E. Hubbell.

39th Annual Conference of the Water Pollution Control Federation, Kansas City, Mo, Sept 25-30, 1966, figs. tables.

Descriptors: Drainage systems, *Weirs, Outlets, Flowmeter, Rain gages, Sampling, *Overflow.
Identifiers: *Combined sewers.

The first year's operation of the Twelve Town Drainage District's relief drainage system is reported. A high weir skimming structure at the outlet is described, and flow metering, a rain gage network, and laboratory facilities at the Outlet Structure (including automatic samplers) are noted. Sewage and overflow characteristics are compared, and primary settling is viewed as not likely to produce significant changes.
W69-01882

DESIGNING OF SEWERAGE SYSTEMS,
A. C. Koot.
Water, Vol 51, No 8, pp 165-69, April 20, 1967.

Descriptors: *Design, *Sewers, *Storm runoff, *Overflow.
Identifiers: *Capacity.

The author summarizes the designing of grit chambers, primary and secondary sedimentation tanks, low- and high-rate trickling filters, low- and high-rate activated sludge plants, and digestion tanks. Sufficient storage capacity in or in addition to the sewerage system for storm overflows is also discussed.
W69-01883

SEWERAGE AND SEWAGE DISPOSAL IN RETROSPECT AND PROSPECT,
M. Lovett.
Surv, Vol 104, 587, 1945.

Descriptors: Sewage treatment, *Storm runoff, *Rainfall intensity, *Storms, Design.
Identifiers: *Combined sewers, *Great Britain, *Surface permeability.

The development of sewerage systems in Great Britain, and disposal and treatment of storm waters are described. In a particular district the extent of impervious areas, intensity of rainfall, localization of storms, and the nature, size, and use of nearby streams determine whether a combined or a separate sewerage system is more suitable.
W69-01888

CONSTRUCTION AND MAINTENANCE OF SEWERS AND DRAINS.

Mass Ann Laws, ch 83, secs 1-13 (1966).

Descriptors: *Massachusetts, *Administration, *Drains, *Sewers, Legislation, Construction, Maintenance, Repairing, Cities, Administrative agencies, Water pollution, Ditches, Sewerage, Treatment, Facilities, Eminent domain, Obstruction to flow, Sewage disposal, Permits, Government finance, Damages, Administration.

Section 1 authorizes specified municipal officials to lay out such drains and sewers as they deem necessary for public health, and to take land necessary for this purpose by eminent domain. Sections 2 and 3 deal with keeping records of sewer and drain plans, descriptions and repairs, and with sewer connections to houses and buildings. Section 4 provides for construction of ditches and drains for highway drainage, and the taking of land by eminent domain for that purpose. Section 5 requires certain landowners to maintain separate plumbing systems for water and sewage. Sections 6 and 7 deal with the establishment of sewage disposal works and pollution or nuisances caused by them. Sections 8 through 10 set forth regulations regarding sewers and drains. They provide fines as high as \$100.00 for excavating public ways for laying or repairing sewers or drains without a permit, obstructing the flow of water in ditches or drains, and obstructing the flow of sewers. Sections 11 and 12 provide fines for refusal to connect with common sewers or to repair private drains. Section 13 vests equity jurisdiction in certain courts to enjoin unlawful use of sewers. (Smidish-Fla)
W69-01926

5F. Water Treatment and Quality Alteration

CHEMICAL EFFECTS OF BOTTOM DEPOSITS ON QUALITY OF IMPOUNDED WATERS.

Massachusetts Univ., Amherst, Dep of Civil Engineering.

Tsuan Hua Feng, and Henry C. Hyde, Jr.
Mass Univ. Water Resources Res Center, Symp Proc, Publication No 3, pp 100-119, June 2, 1967.
20 p, 14 fig, 1 tab, 18 ref.

Descriptors: *Water quality, *Hypolimnion, *Bottom sediments, *Decomposing organic matter, *Laboratory tests, Biochemical oxygen demand, Phosphates, Nitrogen compounds, Dissolved oxygen, Impounded waters.
Identifiers: Biological studies, Biochemical process.

Chemical effects of bottom deposits on water quality in the hypolimnion at 20 deg C were studied in laboratory sediment-water columns. Chemical analyses of both the water and the deposits were made to establish the relationship between the transformations of the chemical constituents in the deposits and the changes of chemical quality of the water. Columns 6 in. in diameter and 4.25 ft high were filled with 4 in. of sediment and 4 ft of tap water and kept in darkness at 20 deg C for 6 mo. The 3 sediment samples were digested sludge from a primary treatment plant, bottom deposits from a pond receiving sewage effluent, and bottom deposits of a river receiving untreated paper mill waste. Chemical analysis data are presented in 1 tab and 14 graphs. BOD decreased in the deposits and remained constant in the water. Nitrogen was concentrated in the top 0.75 in. of the deposits, and nitrate concentration increased to 40-140 ppm in the water columns. Phosphates moved from the deposits into the water. Dissolved oxygen was depleted enough to be harmful to most aquatic life. The most rapid quality depletion was in the first 3 mo. (Knapp-USGS)
W69-01633

5G. Water Quality Control

CHEMICAL EFFECTS OF BOTTOM DEPOSITS ON QUALITY OF IMPOUNDED WATERS.
Massachusetts Univ., Amherst, Dep of Civil Engineering.

For primary bibliographic entry see Field 05F.
For abstract, see .
W69-01633

PESTICIDE OCCURRENCE, CONCENTRATION AND DEGRADATION IN FREE WATER SYSTEMS.

Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-01634

ADSORPTION OF PESTICIDES ON EARTH MATERIALS.

Massachusetts Univ., Amherst, Dep of Plant and Soil Sciences.

For primary bibliographic entry see Field 05C.
For abstract, see .
W69-01635

ATMOSPHERIC CONTRIBUTIONS TO WATER QUALITY OF STREAMS IN THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE.

U. S. Geological Survey and Sears, Roebuck and Co., Chicago, Illinois, and Dartmouth College, Hanover, New Hampshire.

For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01644

THIRTEENTH ANNUAL REPORT, 1963-64.
Mersey River Board.

78 pp, 8 plates, 2 maps.

Descriptors: *Water pollution control.
Identifiers: *Storm sewers, Great Britain.

This report of the Mersey River Board, which is to be superseded by the Mersey and Weaver River Authority, includes a section on the prevention of pollution; a map showing the general condition of rivers and streams in the area, according to a colour-coding scheme; and tabulated data obtained in river surveys. Quarterly chemical surveys of all the major rivers showed a slight improvement in water quality as compared with the previous year and with 6 of the previous 8 years. Sources of pollution and remedial action are outlined and detailed observations are reported on the river Alt, Ditton brook, Sankey brook and Glaze brook. The Board encourages the centralized treatment of sewage in larger plants, the discharge of trade waste waters to sewers, and the construction of separate storm-sewage systems. Observations are being continued on the self-purification and re-oxygenation which occur when a polluted stream passes through a large lake.
W69-01768

POLLUTION CONTROL MEASURES FOR STORM WATERS AND COMBINED SEWER OVERFLOWS.

D. D. Dunbar, and J. G. F. Henry.
Can Mun Utilities (Sewerage Manual and Directory) pp 12-20, 1964.

Descriptors: *Water pollution control, *Storm runoff, *Overflow.
Identifiers: *Combined sewers, *Storm sewers.

Relative importance of other sources of pollution, such as mixtures of storm water runoff and raw sewage being discharged from combined sewer

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

systems, as well as pollutive capabilities of storm water being discharged from separate sewer systems are assessed, and merits of various control measures examined; review of investigations made to study extent of pollution originating in combined and in separate storm sewer overflows.
W69-01811

RIVER POLLUTION BY STORM OVERFLOWS. AN ATTEMPT AT RATIONALIZATION,
H. C. Gatehouse.
Surv'r Municipal Engr., Vol 123, No 3754, pp 33-34, 37-39, 1964.

Descriptors: *Water pollution, *Storm runoff, *Overflow, Water pollution control, Discharge (Water).
Identifiers: *Combined sewers.

The author criticizes the interim report of the Technical Committee on Storm Overflows and points out various unsatisfactory aspects of the measures recommended for the control of pollution by storm-sewage overflows from combined sewers. He stresses the dangers to health of such pollution, and indicates steps that should be taken to eliminate discharges of untreated storm sewage.
W69-01815

DETOURING CALAMITY IN WATER RESOURCE DEVELOPMENT. A CASE IN POINT: SOUTHEASTERN WISCONSIN,
S. W. Havlick.
Trans Wis Acad Sci Arts Lett., Vol 55, pp 59-76, 1966.

Descriptors: *Water pollution control, Recreation facilities, Groundwater, *Sewers.
Identifiers: *Sewer separation, *Storm sewers, *Sewer infiltration, Milwaukee River (Wis.).

After outlining difficulties encountered in the development and management of water resources, including the control of water quality, the author analyses the situation in southeastern Wisconsin with particular reference to the potential utilization of water in the Milwaukee river basin and possible methods for solving the pollution problem. The Milwaukee river is used for industrial water supplies and recreational purposes, but not for potable supplies. Adequate supplies are available from lake Michigan although the costs of treatment are increasing, partly owing to deterioration in water quality. Further deterioration in quality of lake and river water could be prevented by increased waste treatment, separation of sanitary and storm sewers, and elimination of ground-water infiltration into the sewerage system. It is also proposed that the increasing demand for recreational facilities could be met by further development of lakes and reservoirs within easy access, and that flood water from a loop of the Milwaukee river could be diverted into lake Michigan and used subsequently to augment the river flow in dry weather.
W69-01821

RIVER-WATER QUALITY CRITERIA IN RELATION TO WATERWORKS REQUIREMENTS,
G. V. Houghton.
Symp on River Management, U. of Newcastle upon Tyne, Sept. 1966.

Descriptors: *Water quality, *Rain, Chemical analysis.
Identifiers: *Storage tanks.

The type of criteria or tests required to provide satisfactory cleanliness for waterworks requirements are reviewed. The equalizing and purifying effects of rain water storage have always been recognized as beneficial, depending on many factors. If there is no storage, the setting of criteria is simplified in that it is known that every peak of river impurity must be handled effectively or else abstraction stopped. Some caution is warranted

with toxic substances -nitrates, phosphates and polyphosphates, excremental bacteria, organic content and miscellaneous industrial pollution - since storage can have a profound effect on the concentration of some impurities. The need for sufficiently sensitive and reproducible analytical procedures is discussed.
W69-01825

PUBLIC HEALTH - WATER SUPPLY.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-01938

FUTURE WATER QUALITY DESIGN,
California State Department of Public Health, Berkeley.
Frank M. Stead.
Journal of the American Water Works, Vol. 59, No 12, December 1967, pp. 1497-1501.

Descriptors: Water quality, *Water pollution, *Water quality management, Stream conditions, Standards, Industrial wastes, Public health, Water pollution sources, Municipal wastes, *Waste water disposal, Benefits.
Identifiers: Pathogens, Pesticide pollutions, Total management, Aquatic system.

Pollution control alone will not preserve water quality in the U.S. because it is based on a concept of disposal of wastewater from municipalities and industries. In both cases the sewage is no longer wanted, and most often put back into the rivers. With half the total annual water replenishment put to use and converted to wastewater, it is important to consider how much dilution is necessary to keep waters up to present standards. There are three basic choices; (1) discharge the entire waste stream to the ocean or evaporate it, (2) through treatment bring the wastewater up to a sufficient level of quality so that when it is diluted it meets standards for all uses, (3) through treatment bring each individual waste stream up to the standard of quality for a specific use and put resulting 'reclaimed' water to that use directly, without returning it to either surface or ground waters. Current standards concerning pathogens and pesticides have not been given enough study to really indicate possible impairment of human health. What is needed is a new water policy for the U.S. -a policy involving total management of water resources. The entire aquatic system must be analyzed and a new system of distribution in terms of benefits must be devised. (Gargola-Chicago)
W69-01982

WATER QUALITY STANDARDS,
James L. Agee.
Journal of the American Water Works, Vol. 59, No. 12, Dec. 1967, p. 1501-1503.

Descriptors: *Water quality, *Standards, Water pollution, Stream improvement, *Wastewater treatment, Industrial wastes, Water quality control, Municipal wastes, Water pollution sources.
Identifiers: Implementation, Waste treatment plants.

Specific attention is given to certain guidelines issued by the FWPCA. The implementation of standards currently being developed to enhance and preserve water quality will guide the overall water pollution control effort. Specific programs: (1) monitoring streams for standards compliance, (2) monitoring effluents from municipal and industrial waste treatment plants, and (3) periodic review of progress being made to construct needed treatment facilities, will be expanded through joint efforts of state and federal programs. One of the biggest needs in pollution control is efficient municipal and industrial waste treatment plant operation. The area of plant operation has been neglected too long; specific programs to perfect treatment plant operations and surveillance of plant operation are needed if stream water quality criteria are to be

satisfied. New or expanded activities activities to deal with pollution from erosion, vessels, and marinas, mine drainage, heat discharges, land and agricultural drainage and nutrient enhancement will have to be developed by state and federal governments to meet future needs. (Gargola-Chicago)
W69-01988

06. WATER RESOURCES PLANNING

6A. Techniques OF Planning

LAKE SUPERIOR MODEL INDEPENDENT STUDY REPORT,
Wisconsin Univ., Madison, Water Resources Center.

James A. Vierbicher.
Wis Univ Water Resources Center Spec Stud Rep, B-009, May 1967. 3 ref. OWRR-A-004-WIS, OWRR-B-009-WIS.

Descriptors: *Model studies, *Hydraulic models, *Lake Superior, *Design, *Hydraulic similitude, Research and development, Testing, Instrumentation.

A dynamic model of Lake Superior was built to study the effects of winds, shape, stratification, coriolis effects, and energy budget on large scale water circulation. The model is built to have Froude and Rossby numbers similar to those of the lake, distorted horizontal and vertical scales, provision for stratification of fluid content, and provision for wind to induce circulation and flow patterns in the turbulent flow regime. The model may be rotated at 3-300 rpm. The horizontal scale is 1:300,000 and the vertical scale is 1:1,000. (Knapp-USGS)
W69-01596

MANUAL ON URBAN PLANNING - CHAPTER VI: COMMUNITY FACILITIES PLANNING,
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01787

6B. Evaluation Process

A COMPENDIUM OF MAJOR INTERNATIONAL RIVERS IN THE ECAFE REGION.
United Nations, Economic Comm for Asia and the East, Bangkok, Thailand. Div of Water Resources Dev.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01599

COMPREHENSIVE BASIN STUDY SABINE RIVER AND TRIBUTARIES, TEXAS AND LOUISIANA.
Corps of Engineers, Fort Worth District.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01617

THE WATER RESOURCES OF CHILE,
Resources for the Future, Inc, Washington, D C and Inst Latinoamericano de Plan Econ y Social, UNEC for Latin Amer.

Nathaniel Wollman.
Johns Hopkins Press, Baltimore, 1968. 279 p, 68 tab, 3 append, 32 ref.

Descriptors: *Planning, *Metodology, *Economic justification, *Water resources development, Water policy, Model studies, Irrigation, Water supply, Mining, Industries, Municipal supplies, Water law.
Identifiers: Chile, National water planning study.

WATER RESOURCES PLANNING—Field 06

Cost Allocation, Cost Sharing, Pricing/Repayment—Group 6C

The water resources of Chile are examined in detail in a study made to present an example of economic methodology for analyzing national water development planning to engineers, technicians, and administrators. Chile was chosen as an example because of a long tradition of irrigated agriculture and the availability of better hydrological data than can be found elsewhere in Latin America. The model used calculates costs of regulating surface flow to achieve patterns of flow necessary to satisfy regional requirements, including waste dilution to regulate dissolved oxygen, and it calculates waste treatment costs. Total water cost is a function of hydrology and the sum of uses. Future requirements are estimated by projecting population and industrial growth by standard methods. The rate of population growth is 2.43% and GNP growth is 5.5%. There is no foreseeable water shortage in Chile if water supplies are compared with projected requirements. There will be, however, local shortages in drier irrigated areas in the northern provinces. Use of water for agriculture, industry, and municipalities, the cost of water supply and waste treatment, and the effects of shortages are examined in detail. Basic data, including agricultural and industrial production, trends, and predictions, as well as hydrologic data, are compiled in appendixes. (Knapp-USGS)
W69-01654

WATER RESOURCES OF CANADA.

Royal Society of Canada, Toronto.

Toronto Univ Press, 1967. 251 p, 6 parts, misc fig and tab, 31 ref.

Descriptors: *Water resources, Water management (Applied), St. Lawrence River, Great Lakes, Hydrology, Mathematical studies, Eutrophication, Aquatic microbiology, Infiltration, Meteorology. Identifiers: *Symposia, Interdisciplinary papers, Water export, NAWAPA.

Papers of the 1967 symposia on water resources of the Royal Society of Canada are compiled. The major topics are water export in the NAWAPA plan, water as a resource, the role of the St. Lawrence as a transportation route, the Great Lakes, physico-mathematical studies of water, and the biological necessities and hazards of water. Most of the 23 papers are brief reviews of the subjects covered. Bibliographies list the original papers from which the symposia papers were derived. (Knapp-USGS)
W69-01656

DATA AVAILABLE ON SEPARATING COMBINED SEWERS.

For primary bibliographic entry see Field 08A.
For abstract, see .

W69-01715

WATERFRONT RENEWAL IN METROPOLITAN AREAS.

For primary bibliographic entry see Field 04C.
For abstract, see .

W69-01909

THE WATER INDUSTRY AND LOCAL GOVERNMENT,

Henry J. Greaser.

Journal of the American Water Works Association, Vol. 60, No. 1, January 1965, p 1-5.

Descriptors: *Local governments, Optimum development plans, Project planning, Water resource development, Federal governments, *State governments, Financing, Water rates, *Federal jurisdiction, Inter-agency cooperation, Institutional constraints, *Water policy, Water management. Identifiers: National Water Policy, Guidelines.

The National Water Policy of the American Water Works Association states that the responsibility for water resource development should rest with that

echelon of government or private interest closest to the people. The cost should be borne proportionately by those who are benefited. The federal government should only assume the initiative in water resource development when: (1) the project involved is of such magnitude as to beyond the capacity of local groups, (2) a project so complex that no clearly defined local or state group can be identified as principal beneficiaries, (3) federal participation is necessary to assure maximum feasible development in keeping with the comprehensive regional or basin plan, and (4) the programs and projects are not competitive with alternative means of developing water resources by state, local, or private initiative. The state role is clearly delineated in terms of initiative in developments of cooperative water supply projects between agencies of local and federal government. The local systems should bear the primary responsibility for planning, financing, and operating systems for public and industrial water supply. In regard to the funding of projects, criticism of present water rate practices is presented. Now is the time to begin to sell realistic values for water development and water pollution. Everyone in local, state, and federal agencies should seek financial courses which work toward establishing a stable and self-supporting local water and sewage utility and the best way to begin is to get them to pay their own way. (Gargola-Chicago)
W69-01983

TOTAL MANAGEMENT OF WATER RESOURCES.

Office of Science and Technology, Washington, D. C.

Robert L. Smith.
Journal of the American Water Works, Vol. 59, No. 11, November 1967, p 1335-1339, 2 ref.

Descriptors: Economic efficiency, Social needs, Water allocation, *Administrative decisions, *Institutional constraints, Optimum development plans, Multiple purpose, Project planning, Regulation, Local governments, State governments, Several values, *Administration, Adoption of practices, *Non-structural alternatives. Identifiers: Alternative policies, Total management.

Water management cannot aspire to the fulfillment of all society's demands. What is sought is a rational basis for choice and a maximum of flexibility to cope with changes in the services demanded and in the priority that society accords them. The federal government is now the major financier of water development projects; water management must be responsible, however, to a unique combination of hydrologic, economic, and social needs of much smaller areas. For this reason project details and specific regulatory decisions are based on regional or local conditions, and fall to the jurisdiction of the state. To operate effectively within this jurisdictional structure, an organization involved in water management must have an adequate financial base and multipurpose water authority. Everyone seems to support the need for planning in water management, but planning is seldom employed in the development of organizational patterns. Total management should prepare optimum plans for alternative objectives, but the final choice should be exercised by society through the democratic process. It may be asserted that there can be no approximation to total management without an organization whose structure is based on institutional, economic, and jurisdictional, as well as hydrologic considerations. Management must be oriented toward planning responsive to subjective values as well as environmental factors. (Gargola-Chicago)
W69-01985

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ALLOCATION OF STORM DRAINAGE COSTS,

Carl W. Porter.

Pub Works, Vol 94, No 3, pp 164-166.

Descriptors: *Rainfall-runoff relationships, *Storm runoff, *Planning, *Legislation, *Flood control, *Land use, Drainage.
Identifiers: Urban drainage.

Article is portion of 'Paper' presented at 1962 American Public Works Congress. It describes program used in the County of Fairfax, Va. Also states that they are working with U.S.G.S. on a pilot program studying 30 main streams in the County endeavoring to determine rainfall patterns and relate runoff from currently developed areas to storm water runoff. Also have an anti-siltation ordinance with SCS. Article discusses plans and ordinances used to protect the suburban homeowner from inadequate drainage and also protect the downstream property owner from flood damage due to increased runoff from newly developed upstream areas.
W69-01891

SUBURB MEETS URBANIZATION HEAD-ON,

Ayers, Lewis, Norris, and May, Ann Arbor, Mich. For primary bibliographic entry see Field 04C.

For abstract, see .
W69-01895

MEETING FUTURE WATER REQUIREMENTS THROUGH REALLOCATION,

Colorado Univ., Boulder, Department of Civil Engineering.

J. Ernest Flack.
Journal of the American Water Works, Vol. 59, No. 11, November 1967, pp. 1340-1350, 2 tab, 16 ref.

Descriptors: *Water resource development, Water supply, *Water allocation (Policy), Water requirements, Alternative costs, Market values, *Equitable apportionment, Water law, *Legal aspects, Riparian rights, Stream conditions, Capital, Future planning, Water consumption, Economic efficiency, *Water transfer.
Identifiers: California, South Pacific Region, Area of origin right.

Reallocation of water becomes increasingly necessary as readily available sources are exhausted and surplus water becomes more expensive to develop. Unless new sources of water are developed or consumptive uses drastically reduced, the projections of needed water withdrawals for certain areas cannot be realized. The distribution of water shows the South Pacific region will suffer the most severe deficiency of supply for the future. The relative use of water for residential, agricultural, industrial, and urban purposes is discussed, and possible means of reducing these uses given. In discussing the valuation of water rights for purposes of reallocation eight points are considered: (1) cost of acquisition of the original rights, (2) market value, (3) appreciation and depreciation, (4) sale of stock, (5) alternative costs, (6) capitalized earning method, and (7) value in use. The value of reserved rights now in use in California permits the area of origin to exercise a type of riparianism. In order to make an economic allocation of water and still retain some protection for counties of origin certain points would have to be established; (1) quantify the area of origin right and give it priority (2) condemnation of water rights, (3) engineering studies to determine water use before and after the transfer, (4) measuring return flow, (5) maintenance of stream conditions and (6) limiting transfers to new users defined in the public interest. (Gargola-Chicago)
W69-01984

Field 06—WATER RESOURCES PLANNING

Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

WATER PRICING IN RESIDENTIAL AREA,

Charles W. Howe.

Journal of the American Water Works Assn., Vol. 60, No. 5, p 497-501, 1 fig, 1 ref.

Descriptors: Costs, Demand, *Water values, Prices, Competition, *Water demands, *Water costs, Use rates, Market value, Elasticity of demand, Unit costs.

Identifiers: Revenue, Commodity.

A framework is suggested to bring cost-demand considerations together to determine water prices with emphasis on demand for residential water. Applying such a framework to the provision of water service to a residential subdivision involves many complexities. The complexities start with trying to develop a relevant and adequate measure of output and of forecasting water demands. Three measures of demand are discussed: (1) domestic demands on an average annual basis, (2) average summer sprinkling demand, and (3) maximum day sprinkling demand. The amount of water demanded for these purposes is affected by the price charged. In designing new systems or sub-systems that depend on quantity demanded, price is a vital factor. The steps in the design process are: (1) demand forecasts, (2) system design, (3) system costs, (4) pricing, and (5) actual demand. They can be made consistent only if the price demand relationships are taken into account and the proper division made between commodity and fixed charges in the rate structure. (Gargola-Chicago)

W69-01986

BILLING FREQUENCY AND CUSTOMER RELATIONS,

Umbaugh and McQueen, Plymouth, Indiana.

H. J. Umbaugh.

Journal of the American Water Works Association, Vol. 59, No. 6, p 669-674.

Descriptors: Unit costs, Water cost, *Water rates, Water values, Use rates, Public benefits, *Social aspects, Pricing, Economic efficiency, Political aspects, Water users.

Identifiers: *Water billing frequency, Public relations.

Water billing frequency is a judgment decision having many sides, economic, social, and political. In a municipal situation the frequency of billing could be a political decision. Customer relations are greatly affected by this; greater frequency of billing might soften the shock of higher priced service and sewage billing. In smaller communities more frequent billing is influenced by two factors: (1) new sewage plants create a substantial additional burden upon water usage, (2) capital improvement of water facilities can result in a considerable water rate increase. A change from quarterly to monthly billing can help users to adjust to increased costs, especially those on fixed budgets, such as the elderly and welfare recipients. The loss of revenue that could result from a shift to monthly billing is discussed and certain factors of loss mentioned. Greater frequency of billing does allow for better maintenance of the system through early detection of leaks and line losses. The deposit required is discussed and public relation factors considered. Billing frequency should bear some relation to size of billing. In communities where standard charges are less quarterly billing may be quite feasible, but where charges are high and sewage billing on the same account, monthly billing can allow for easier financial adjustments by customers. The ideal situation would be to provide the customer with the billing frequency he finds easiest to adjust to. This is not possible now, but perhaps future developments in technology will allow it. (Gargola-Chicago)

W69-01987

CHALLENGES IN THE WATER INDUSTRY,

For primary bibliographic entry see Field 03D.

For abstract, see .

W69-01989

6D. Water Demand

THE WATER RESOURCES OF CHILE,

Resources for the Future, Inc, Washington, D C and Inst Latinoamericano de Plan Econ y Social, UNEC for Latin Amer.

For primary bibliographic entry see Field 06B.

For abstract, see .

W69-01654

PROPOSALS FOR STUDYING THE FEDERAL STATE WATER RIGHTS PROBLEM,

Los Angeles Department of Water and Power.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-01981

6E. Water Law and Institutions

CONSTRUCTION AND MAINTENANCE OF SEWERS AND DRAINS.

For primary bibliographic entry see Field 05D.

For abstract, see .

W69-01926

TURNER V WASHINGTON SUBURBAN SANITARY COMMISSION (EASEMENTS AND DISCHARGE OF SURFACE WATERS).

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01928

JOHNSON V SEIFERT (RIPARIAN OWNER'S RIGHT TO USE OF ENTIRE LAKE SURFACE).

100 N W 2d 689-697 (Minn 1960).

Descriptors: *Minnesota, Judicial decisions, *Riparian rights, Lake beds, Ownership of beds, Riparian land, *Diversion, *Lakes, Navigable waters, Non-navigable waters.

Plaintiff riparian owner brought suit against defendant co-riparian owner to enjoin his restriction of plaintiff's use of two lakes by maintaining a fence through them, and from withdrawing water from the lakes for irrigation. Defendant had constructed a fence along his property line, through the lakes, cutting off plaintiff's access to the main portions of each lake. Defendant contended that the lakes were non-navigable and that plaintiff only had a right to the use of the water over the property he owned. On appeal, the Minnesota Supreme Court held that riparian rights arose from ownership of the shore, not the lakebed, and that each riparian owner had a right to use the entire surface of the lake in common with other riparian owners. The court expressly overruled Lamprey v Donz 86 Minn 317, 90 NW 578, in holding that whether a lake is navigable or non-navigable does not effect riparian rights. The federal test of navigability is not binding. The court also held that the withdrawal for irrigation was reasonable. Defendant only owed a duty to plaintiff not to unreasonably lower the lake level. (Williams-Fla)

W69-01929

BLAKE V UNITED STATES (OBSTRUCTIONS IN NAVAL ANCHORAGE AREA).

181 F Supp 584-591 (E D Vir 1960).

Descriptors: *Federal government, *Rivers and Harbors Act, Navigation, *Rivers, Oysters, Channels, Leases, State jurisdiction, State governments, Navigable rivers, Compensation, *Bouys, Navigable.

Identifiers: Navigation obstructions.

Libellants in this case were lawful holders of oyster ground leases, issued under the laws of Virginia. These grounds were in the lower York River. The United States Government established, in the same general area, a naval mine sweeping practice area and a naval drill minefield area. Public hearings were held prior to this action, and public notice of the hearings was given, although there was no personal notice to the libellants. Certain portions of libellants' grounds were within these restricted areas, and the stakes and bouys used to mark the boundaries were removed by the Navy. Libellants contended that this action rendered their grounds valueless, therefore constituting a taking for which the Fifth Amendment required just compensation. The court held that even though the markers and bouys were private property as contemplated by the constitutional provision, the federal government has a dominant power over navigation. Thus, congress may provide for removal of obstructions to navigation, as in the Rivers and Harbors Act. Such a removal is not a 'taking' requiring compensation. (Williams-Fla)

W69-01930

JOINER OF PARTIES WHEN LITIGATING WATER RIGHTS,

W. Patterson.

Baylor L Rev, Vol 11, No 2, pp 181-192, Spring 1959. 12 p, 18 ref.

Descriptors: *Water rights, *Texas, *Adjudication procedure, Water law, Legal aspects, Water utilization, Natural flow, Diversion, Relative rights, Water users.

Identifiers: *Joinder of parties.

Laws concerning parties litigating water rights controversies are discussed. There are three classifications of parties: (1) 'proper'; (2) 'necessary'; and (3) 'indispensable.' Texas courts have repeatedly treated necessary and indispensable parties alike. Cases which indicate the confused state of the law concerning the necessity or indispensability of parties are considered. The author also discusses class actions in water rights controversies. The Texas law is unclear as to when class actions are appropriate. The author points out that the major cause of the confusion in the law is the inaction of the legislature. (Horner-Fla)

W69-01931

JONES V DES MOINES AND MISSISSIPPI RIVER LEVEE DIST NO 1 (LEVEE DISTRICT'S LIABILITY FOR OVERFLOW).

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01932

INTERNAL IMPROVEMENT TRUST FUND.

Fla Stat 253 secs 253.01--253.05, pp 1197-1200 (1967).

Descriptors: *Administrative agencies, *Florida, Land management, Land tenure, Conservation, Surveys, *Ownership of beds, Beds, Bays, Beds under water, *Legislation.

Identifiers: Internal improvement trust fund, Tidal lands, Swamp lands.

Florida, by statute, established a distinct trust fund comprised of the title to and revenues from the sale of specified state lands. Swamp and overflow lands held by the state, all land held by right of sovereignty, all internal improvement lands, all tidal lands and other enumerated lands, make up the land holdings of the fund. Title to the land and control and administration of the fund are vested in the governor and the cabinet as trustees. They are required to maintain a land office with complete records on all fund land and to prosecute any suit deemed necessary for the protection and preservation of fund lands. They are responsible for creating a comprehensive plan for management, acquisition, and disposition of state owned lands to insure maximum benefit and use. (Geraghty-Fla)

W69-01933

INTERNAL IMPROVEMENT TRUST FUND.

Fla Stat 253 secs 253.111–253.128, pp 1200-1206 (1967).

Descriptors: Highwater mark, Boundaries (Property). Riparian land, Riparian rights, Sand bars, *Bulkhead line, Hydrographs, *Landfills, Ecology, *Conservation, Recreation facilities, Local government, Wildlife, *Legislation, Dredging. Identifiers: Internal improvement trust fund.

The trustees, before disposing of land to which they hold title, must afford the county in which such land is situated an opportunity to receive such land for public purposes. However, if a riparian owner shall exist, his right to secure such land shall be prior in interest to the county's. The title to all sovereignty tidal and submerged bottom lands, including islands and sand bars created by dredging, is vested in the trustees of the fund. Before this land can be sold, it must be determined to what extent such conveyances would interfere with the conservation of marine, wildlife or other natural resources. The State Board of Conservation, after hydrographic surveys and ecological studies, makes recommendations to the trustees as to the probable effect on the area's resources. Local governments have the power to fix bulkhead lines subject to approval by the trustees. Once established, any extension creating or filling of land beyond such lines into county waters shall be deemed an interference with navigation. Removal of sand, rock or other material from navigable waters of the state to be used as fill is prohibited unless provided for in a construction permit. Any person, natural or artificial, wishing to construct islands or add to existing lands bordering on or in the navigable waters of the state, must obtain a permit to do so from the county wherein such construction is desired. (Geraghty-Fla)

W69-01934

INTERNAL IMPROVEMENT TRUST FUND.

Fla Stat 253 secs 253.129–253.601, pp 1206-1215 (1967).

Descriptors: Construction, *Riparian rights, Railroads, Land tenure, *Legislation, Legal aspects, Drainage programs, Marshes, Phosphates, Oil, *Leases, Surveys, Federal government, *Administrative agencies, Riparian land. Identifiers: Homestead, Internal improvement trust fund.

Title to all lands filled or developed prior to the enactment of this statute is vested in the upland owners. Private riparian owners may bring suits to enjoin the sale of fund lands, if such a sale would deprive them of riparian rights granted by law. Canal and railroad construction is encouraged by grants of fund land under specified conditions, which include forfeiture if construction is not begun within a prescribed period. The trustees are empowered to borrow money for draining and reclaiming specified swamplands. There is also a provision for homesteading certain lands held by the fund. Title to permanently reclaimed marsh lands belonging to the state is vested in the trustees of the fund. Surveys must be made of such land and if it is sold, first right to purchase must be given to the adjoining owner. Unsurveyed marsh lands are to be sold to the record owners of uplands which have been surveyed by the United States. The trustees may exchange fund lands with private individuals or corporations and enter into agreements for the sale or lease of mineral rights on fund land or for the lease or sale of gas and oil rights on the bottoms of specified bodies of water. (Geraghty-Fla)

W69-01935

EXTINCTION BY PRESCRIPTION OF NATURAL SERVITUDE FOR DRAINAGE OF SURFACE WATERS,
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01936

SEC 5E TO ISSUE LICENSE FOR APPLICATION OF CHEMICALS TO WATERS FOR CONTROL OF AQUATIC NUISANCES, ETC. SEC 5F TO CONTROL ALGAE, WEEDS AND AQUATIC NUISANCES IN CERTAIN BODIES OF WATER, ETC.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01937

PUBLIC HEALTH - WATER SUPPLY.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-01938

SARGENT V GAGNE (EASEMENT TO USE OF WATER SUPPLY ON THE LAND OF ANOTHER).
For primary bibliographic entry see Field 04B.
For abstract, see .
W69-01939

WESTBURY REALTY CORP V LANCASTER SHOPPING CENTER, INC (ARTIFICIAL USE OF LAND GIVES RESPONSIBILITY FOR INCREASED SURFACE WATER FLOW).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01940

ROCKWELL V STATE (HIGHWAY DRAINAGE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01941

NOLAN V CARR (MUNICIPALITY'S LIABILITY FOR SURFACE DRAINAGE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01942

MATZOK V GLEN COVE YACHT SERVICE REPAIR, INC. (EASEMENT OF ACCESS TO NAVIGABLE PORTION OF STREAM).

189 NYS 2d 249 (Sup ct NY 1959).

Descriptors: *Easements, *New York, *Riparian rights, Dredging, Streams, Navigable rivers, Judicial decisions, *Intertidal areas, Riparian land, Banks. Identifiers: Upland.

Plaintiffs sought judgment establishing an easement over adjoining property, the purpose being to enforce alleged riparian rights. One of the plaintiffs' predecessors in interest owned upland and part of the foreshore bordering on the creek. The deed to plaintiffs had expressly included riparian rights. After dredging operations no part of plaintiffs' property touched on a navigable portion of the creek. Defendant, who was the successor in interest to the remaining property, filled in the foreshore and created a lot. The court found that the fact that part of a foreshore is owned by another, and filled in by him so as to transform foreshore into upland, does not deprive the owner of adjacent foreshore from asserting riparian rights. An easement was granted allowing access to the navigable part of the stream, but not entitling plaintiffs to unreasonably interfere with the use of the property. (Kahle-Fla)

W69-01943

BOSTICK V SMOOT SAND AND GRAVEL CORP. (RIGHTS OF RIPARIAN OWNERS TO CONTROL THE REMOVAL OF SAND AND GRAVEL).

260 F 2d 534-541 (4th Cir 1958).

Descriptors: Judicial decisions, *Maryland, Virginia, *Dredging, Permits, Legislation, Legal aspects, *Boundaries (Property), Low water mark, *Ownership of beds, High water mark, Riparian waters. Identifiers: *Riparian owners, Potomac River.

Appellants were owners of property in Virginia on the Potomac River. Appellee was a corporation engaged in dredging and removing sand and gravel from the Potomac River between the low water mark on the Virginia side, which was the boundary line between Maryland and Virginia, and the outer line of the channel on the Virginia side. Appellee worked under a license granted by the United States Corps of Army Engineers, but did not acquire the permission of the appellants. Appellants brought an action in trespass, for nuisance. The court held that appellants were contemplated by the Maryland statute that prohibited removal of sand and gravel from the area in which appellee was dredging, except by riparian owners of land bordering the Potomac River. Appellees, therefore, were liable for damages and for removal of the sand and gravel without appellant's permission. (Sisson-Fla)

W69-01944

UNITED STATES V BIGAN (VIOLATION OF RIVERS AND HARBORS ACT).

170 F Supp 219 (E D Pa 1959).

Descriptors: *Overburden, *Pennsylvania, Federal government, *Rivers and Harbors Act, Strip mines, Banks, Barriers, Structures, Obstruction to flow, Navigable rivers, Judicial decisions. Identifiers: Allegheny River, Nuisance, Injunctions.

Plaintiff sought prohibitory and mandatory injunctions against defendant for alleged violations of sections 9, 10, 12, and 13 of the Rivers and Harbors Act. Defendant in carrying on strip mining operations, had deposited overburden on an abandoned road 500 feet above the Allegheny River. Heavy rains subsequently washed the overburden down the bank, carrying uprooted trees and underbrush with it into the river and thereby creating a bar. The court found that section 9, prohibiting constructions in navigable rivers, was not violated. Section 10, also prohibiting obstructions, is penal, and implies intentional acts. It was not shown that defendant willfully intended an obstruction. Defendant did violate the first part of section 13, which makes it unlawful to deposit refuse in navigable waters. However, since defendant had abandoned mining operations, a prohibitory injunction was not granted. Defendant did not violate the second part of section 13, making it unlawful to deposit material on the bank of navigable waters, since the road 500 ft. above the river could not be considered a bank. The bar is not within section 12, which restricts statutory injunctive power to structures in violation of sections 9, 10, and 11. The plaintiff is not entitled to mandatory injunction for removal because it does not appear that the bar is a public nuisance. (Kahle-Fla)

W69-01945

YEATES V MILLSAPS (OIL POLLUTION).

For primary bibliographic entry see Field 05C.
For abstract, see .
W69-01946

BOARD OF COMM'R'S V BARON (DISTRICT NOT ALLOWED TO APPROPRIATE NON-RIPARIAN LAND FOR LEVEES AND DRAINAGE).

236 La 846, 109 So 2d 441-444 (1959).

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

Descriptors: Judicial decisions, *Louisiana, *Riparian land, *Levees, Administrative agencies, Appropriation, Drainage, Streams, Navigable rivers, Public utility districts, Ditches, Mississippi River, *Eminent domain.

The district commissioners sought to evict the defendant from land appropriated by the district for levees and levee drainage purposes. The defendant lost at the trial court, but the decision was reversed on appeal. The district based its appropriation on a La statute which imposes a servitude in favor of the public upon lands adjacent to navigable rivers and streams for the purpose of constructing and repairing levees, roads and other public or common works. The property in question, however, was adjacent to a man-made drainage ditch which was located over 3 miles from the nearest navigable river or stream. Since the land was not riparian, it could not be appropriated under the statute. (Watson-Fla)

W69-01947

HOLBROOK V MASSACHUSETTS TURNPike AUTHORITY (ACTIONS FOR DAMAGES BY LANDOWNER FOR FLOODING CAUSED BY FILLING LAND TAKEN BY EMINENT DOMAIN).

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01949

BLUMER V WISCONSIN RIVER POWER CO. (LANDOWNER'S SUIT AGAINST DOWNSTREAM DAM OWNER FOR RAISING THE WATER TABLE).

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01950

RAND V MILLER (ACTION TO QUIET TITLE TO ACCRETION LANDS SEPARATED FROM RIPARIAN LANDS BY AVULSION).

95 NW 2d 916-920 (Iowa 1959).

Descriptors: Judicial decisions, *Iowa, Riparian rights, Missouri River, *Accretion (Legal aspects), *Alluvion, Navigable rivers, High water mark, Boundaries (Property), Interstate compacts, Channels, *Alluvial channels, Dikes.

Suit to quiet title was brought by an Iowa riparian owner claiming title to certain lands by accretion, deed, and adverse possession. The plaintiff won at the trial court, and the decision was affirmed by the Supreme Court of Iowa. The land in question accreted to the plaintiff's land on the Iowa side of the Missouri River from a period prior to 1912 until the mid-1940's. In 1946 or 1947, the river changed courses detaching the land in question from the Iowa side and attaching it to the Nebraska side of the river. The court held that the plaintiff had acquired good title to the land and it was still his although now on the Nebraska side of the river, the land was identifiable, and the Army Corp of Engineers planned to reroute the river to its former channel. (Watson-Fla)

W69-01951

CITY OF MADISON V TOLZMANN (CITY ATTEMPTING TO REQUIRE A LICENSE TO OPERATE BOAT UPON NAVIGABLE STATE WATERS WITHIN ITS JURISDICTION).

7 Wis 2d 570, 97 N W 2d 513-517 (1959).

Descriptors: *Wisconsin, Judicial decisions, Legislation, *Cities, Mississippi River, Lakes, Rivers, Streams, Taxes, *Navigable waters, *Jurisdiction, Boating regulations, St. Lawrence River, Permits, Fishing, Swimming, Navigation, Skiing, Beds, Ownership of beds.

Identifiers: Public trust doctrine.

The city of Madison, Wisconsin, imposed a fine on the defendant for violation of city ordinances by unlawful operation of a boat upon navigable water

subject to city jurisdiction without registration of the boat and not having a life preserver for each person. The Supreme Court of Wisconsin affirmed the portion of the judgment pertaining to the life preservers, but reversed the fine for operating a boat without a license. The Supreme Court held that in view of a constitutional provision that the state should have concurrent jurisdiction over navigable waters leading into the Mississippi and St. Lawrence rivers, even if the state had delegated to the city the authority to enact safety regulations, the city had no implied power to enact, as a means of enforcement of such regulations, a boat registration and licensing ordinance provision which resulted in an exaction of fees for the use of navigable waters which were within the city's boundaries. Beds of navigable waters are held by the state in trust for use by the public, and the trust doctrine applies not only to rivers or lakes forming a common boundary to the state but also to inland navigable meandered lakes. (Watson-Fla)

W69-01952

WISEMAN V TOMRICH CONSTRUCTION CO (ACTION FOR DAMAGES FROM WRONGFUL DIVERSION OF SURFACE WATERS THROUGH STORM DRAIN).

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01953

NANTAHALA POWER AND LIGHT CO. V HORTON (CONDEMNATION VALUE OF RESERVED WATER RIGHTS).

249 N C 300, 106 S E 2d 461-467 (1959).

Descriptors: Condemnation, *Condemnation value, Eminent domain, Easements, Legal aspects, *North Carolina, Dams, Backwater, Floods, *Water rights, Mining, Compensation, Impounded waters, Hydroelectric power, Access routes, Judicial decisions, Real property.

Identifiers: Tuckasegee River, Mineral rights.

A power company condemned easements giving it the right to build a dam on its own property and thereby impound waters which would flood a portion of a tract in which respondents each claimed an interest. The condemnor was ordered to pay \$11,500. The rights of all respondents depended upon the legal effect of a deed conveying the fee subject to certain 'exceptions, limitations and reservations' which, entitled the grantor and his successors to the mineral and water rights. Respondents Horton and Strikeleather were successors in interest of the grantor and grantee respectively. Horton contended that, since he owned the water power rights in the tract, which were all the power company acquired by condemnation, he was entitled to receive the entire \$11,500. The court held that the deed in question vested in Horton only such water rights susceptible to development within the tract. The easement condemned gave the Power Company substantially greater rights than were possessed by Horton. The amount of compensation was proportionate to the loss shown to have been proximately caused by condemnation. No evidence was introduced showing Horton sustained more than nominal damages, and hence Strikeleather, owner of the fee, was entitled to the \$11,500. (Bozarth-Fla)

W69-01954

AETNA INSURANCE CO. V WALKER (MEANING OF SURFACE WATERS).

98 Ga App 456, 105 S E 2d 917-921 (1958).

Descriptors: *Georgia, Judicial decisions, Surface drainage, Surface runoff, *Surface waters, *Standing waters, *Spring waters, Insurance, Risks.

Insured, Walker, brought suit against the insurer under a policy protecting his property from all physical loss, subject to certain exceptions, one of

which was damage from surface water. The insured claimed he suffered damage from seepage from three subterranean springs which caused waters to stand around and seep into the foundation of his house. The insurer defended the suit on the ground that the damage to plaintiff's property fell into the class excluded from coverage under the policy. On appeal, the Georgia court of appeals, held that the damage described by plaintiff was caused by surface water as contemplated in the policy exception. The court held that surface waters include both rain water and water that arises from springs, which diffuses itself over the ground and neither follows nor gathers itself into a definite channel. (Williams-Fla)

W69-01955

LETTERMAN V ENGLISH MICA CO. (FLOODING ABOVE DAM).

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01956

WEST KY COAL CO V RUDD (ACTION BY FARM OWNER AGAINST 8 COAL MINING CO'S TO ENJOIN DISCHARGE OF COAL WASTES).

For primary bibliographic entry see Field 05B.

For abstract, see .

W69-01957

CORRINGTON V KALICAK (LIABILITY FOR CAUSING FLOOD BY OBSTRUCTING A STREAM).

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01958

CITY OF SPRINGFIELD V MECUM (VALIDITY OF CITY BOATING ORDINANCE).

320 S W 2d 742-748 (Ct App Mo 1959).

Descriptors: *Missouri, Lakes, Judicial decisions, *Cities, *Boating, Legislation, Local government, Ownership of beds, *Regulation, Public rights.

Identifiers: Police power.

Defendants were convicted of violating a city ordinance which forbade the use of an outboard motor of over six horsepower on Lake Springfield. This lake was created by a dam and was on land owned by the city. Defendants appealed and the Springfield Court of Appeals held that the ordinance was a valid and reasonable exercise of the police power granted by statute to the city, allowing it to police lands owned by the city and used by the public, whether within or without the corporate boundaries. (Williams-Fla)

W69-01959

REMOVABLE BRIDGES OVER CERTAIN CANALS - SEWAGE DISPOSAL IN HIGHWAY DITCHES - DRAINING OF PUBLIC ROADS.

La R S 1965 48: 383, 385, 483.

Descriptors: *Louisiana, *Legislation, *Administrative agencies, Canals, Bridges, Bridge construction, Bridge design, *Highways, Road construction, Drainage, Irrigation, Canals, Floats, Dredging, Ditches, Sewage, Effluents, Public health.

Bridges which are built over a drainage or irrigation canal which was dug or may be subject to cleaning by a floating dredge must be of a design approved by the Chief Engineer of the Department of Highways which shall permit quick, easy, and efficient removal and replacing to facilitate the cleaning of the canal. No industrial wastes, sewage, septic tank effluent, nor any noxious or harmful matter, solid, liquid, or gaseous, may be discharged into the side or across ditches or placed upon the rights of way of state highways, without having first obtained the prior written consent of the Director

Water Law and Institutions—Group 6E

of Highways and the La State Board of Health. The Parish governing authorities are authorized to drain the public roads of their parishes by cutting ditches and canals where necessary through private property. The ditches and drains must be of sufficient size to drain both the public road and the lands over which they are opened. They must also be located where least injurious to the owner of the property. (Watson-Fla)
W69-01960

LAYING-OUT OF ROADS - WHAT ARE PUBLIC ROADS - COMPENSATION OF OWNERS.

La RS 1965 48:491, 493.

Descriptors: *Louisiana, *Legislation, *Highways, Rivers, Bayous, Cities, Damages, Beds, Alluvium, Accretion (Legal aspects), Riparian rights, Navigable rivers, Navigable waters, Watercourses (Legal), *Eminent domain, Condemnation value.

All roads built or maintained for 3 years by any governmental authority are deemed public roads. Also all roads or streets made on the front of their respective tracts of lands by individuals when the lands have their front on any of the rivers or bayous with the state shall be public roads and streets. Any person through whose land a public road is laid out may claim just compensation to be determined by a jury and paid by the parish. Compensation is not available, however, to any person whose land is considered a public road because the front of it runs along a navigable river or watercourse within the state. (Watson-Fla)
W69-01961

AMERICAN CYANAMID CO. V SPARTO (INDUSTRIAL POLLUTION).

For primary bibliographic entry see Field 05C.

For abstract, see .

W69-01962

TRANSFER OF LANDS BY LEVEE BOARDS AND SCHOOL BOARDS--DYKES OR DAMS--EXCAVATIONS.

La RS 1965 56:723-724.

Descriptors: *Louisiana, *Legislation, *Administrative agencies, Levees, Streambeds, Ownership of beds, Non-navigable waters, Streams, Overflow, Wildlife habitats, *Wildlife management, Wildlife conservation, Preservation, Game birds, Fish management, Dams, Canals, Lakes.

Levee boards and school boards owning land in the beds of non-navigable streams, where the lands are annually overflowed, may sell the lands to any parish for the purpose of establishing a game or fish preserve. The governing authority of a parish may build dykes or dams, dig canals, or excavate lake or stream beds whenever such work is necessary to the creation and establishment of these preserves. (Watson-Fla)
W69-01963

DEFINING INSIDE AND OUTSIDE SHRIMPING WATERS.

La RS 1965 (1968 Supp) 56:495.

Descriptors: *Louisiana, *Legislation, *Fishing, *Fish management, Mississippi River, Water, Lighthouses, Islands, Beaches, Bayous.
Identifiers: Shrimp.

The shrimping waters of the state of Louisiana are divided into two classes, inside and outside waters. The dividing line between inside and outside waters is a line commencing from the mouth of Sabine Pass in an easterly direction following the offshore beaches to South Point on Marsh Isle, thence in a direct line to Eugene I Lighthouse; then continuing in an easterly direction along the beaches to the west end of Isles Dernieres and then easterly along the beaches of Isles Dernieres, Wine Isle and Tim-

balier Islands to the Mouth of Bayou Lafourche; then eastward along the beaches of the mainland mass including Grand Isle and Grand Terre to the Mississippi Delta; then along the shores of the Mississippi Delta, excluding the passes of the River to Bird Island; thence in a northeasterly direction to and along the beaches of the Breton Island and Chandeleur Island complex to the Mississippi line. Map is attached. (Watson-Fla)
W69-01964

DEVELOPMENT OF IRRIGATION DISTRICTS.

Ala Const Ammend no 227.

Descriptors: *Alabama, *Legislation, Administrative agencies, *Irrigation districts, Water contracts, Water conservation, United States, Cities, *Financing, Electric power, State governments, Local governments.

Identifiers: Counties, Bonds.

The legislature of Alabama may by general, special, or local laws authorize the formation of a body corporate for the development of one or more irrigation districts for the purposes of providing irrigation and water conservation in the state. The legislature may also authorize: (1) the counties and municipalities lying within the boundaries of such districts to contribute public funds to the district; (2) the corporate body to enter into contracts with the United States, other states or their political subdivisions, and other irrigation districts; (3) the corporate body to issue revenue bonds payable solely out of revenue accruing to it; and (4) the corporate body to do all other acts necessary and proper for the full development of the irrigation district except the production, transmission, or sale of electric power. (Watson-Fla)
W69-01965

NAVIGABLE WATERWAY BETWEEN DEMOPOLIS AND TENNESSEE RIVER AND FLOOD CONTROL PROJECTS ON TRIBUTARY STREAMS OF TOMBIGBEE RIVER.

Ala Const Ammend no 270.

Descriptors: *Alabama, *Legislation, *Administrative agencies, *Financing, Navigable rivers, Rivers, Navigable waters, Flood control, Streams, Channels, Tennessee River, Tributaries, United States, Interstate compacts.

The legislature of Alabama may by appropriate laws authorize the state to engage in works of internal improvement by fulfilling the requirements of local contribution, participation, and cooperation established by the United States in connection with the construction and maintenance of a navigable waterway between Demopolis, Ala and the Tennessee River and the implementation and maintenance of flood control projects on the tributary streams of the Tombigbee River. The legislature may also issue bonds, not exceeding \$10 million, pledging the full faith and credit of the state to pay for these projects. The legislature is further authorized to create a public corporation to administer the funds provided. (Watson-Fla)
W69-01966

NUISANCES: MANUFACTURING PLANT NOT A NUISANCE AFTER OPERATING FOR ONE YEAR; DAMAGES ON ACCOUNT OF POLLUTION OR OVERFLOW OF STREAM.

Ala Code, tit 7, secs 1088-1089 (1958).

Descriptors: *Alabama, Legislation, *Water pollution, Overflow, Damages, Flood damage, *Industrial plants, Industrial wastes, Legal aspects.

Section 1088 declares that a manufacturing plant is not a nuisance after operating for one year when it was not a nuisance when the operation began, unless a nuisance results from negligent or improper operation of the plant. Section 1089, however,

preserves the right of any person, firm, or corporation to recover damages for any injury sustained on account of any pollution of the waters of any stream or any overflow of the lands of any person, firm, or corporation. (Sisserson-Fla)
W69-01967

WATERSHED CONSERVANCY DISTRICTS.

Ala Code, tit 2, secs 670 (1)-(17) (1958).

Descriptors: *Alabama, *Legislation, *Administrative agencies, *River basin commissions, Erosion control, Flood control, Water conservation, Watersheds (Basins), Water utilization, Watershed management, Soil conservation, Financing, Project feasibility.

The procedure for formation and discontinuance of watershed conservancy districts is given. The districts may be formed to develop and execute programs in the conservation of water, water usage, flood prevention, flood control, erosion prevention, and control of erosion, floodwater and sediment damages. The land embraced in any district must be contiguous and lie within a well defined watershed. To form a watershed conservancy district a petition must first be filed with the board of supervisors of the soil conservation district in which it is located. After the petition is received and adequate notice has been given a public hearing is conducted by the board of supervisors to determine the practicability and feasibility of creating the proposed subdistrict. If approved at the hearing, a referendum will be held within the proposed district to see if a majority of the landowners approve the proposed district. If approved by referendum the watershed conservancy district is created. The powers of the directors and the procedures for their election are given. Procedures for modification of the district and conducting referendums on proposed bond issues are also listed. (Watson-Fla)
W69-01969

ERECTION OF DAMS FOR MILLS, GINS OR FACTORIES.

Ala Code tit 19, secs 34-55 (1958).

Descriptors: Hydroelectric plants, *Alabama, Damages, Flood damage, Dam construction, *Damsites, *Non-navigable waters, Mills, Industrial plants, *Legislation, Eminent domain, Public benefits.

Permission to erect a dam for any mill, factory, or gin across any non-navigable watercourse may be granted to the fee owner of land on one or both sides of the watercourse by application to the probate court of the county where the dam is to be erected. Since the proceeding is eminent domain, the structure must be operated for the public. Upon application and notice to the opposite owner 7 jurors will assess possible damage to surrounding land and the value of one acre of opposite land. If the court finds that no residence, outhouse, enclosure, garden, orchard, or other mill will be overflowed and that health will not be endangered, the application will be granted. The applicant must pay the assessed damages and the value of the acre of land within 3 months or the grant will be revoked. Payment for the acre vests fee ownership in the applicant, but failure to construct and maintain the dam within time limits will cause reversion to the former owner. Permission to raise a dam or put a canal through another's land may be granted under the same proceedings. Failure to comply gives rise to double damages. Landowners may appeal to the Circuit Court as a matter of right concerning damages or by certiorari as to irregularities in the proceedings. (Kahle-Fla)
W69-01970

LEASE OF LANDS UNDER NAVIGABLE WATERS, ETC (DEVELOPING MINERAL, GAS, AND OIL RESOURCES).

Ala Code, tit 26, sec 179 (56 L) (1958).

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

Descriptors: *Alabama, Legislation, Administrative agencies, Gulf of Mexico, Resources, *Natural resources, Oil, Navigable waters, *Ownership of beds, Riparian rights, Mineralogy, Conservation, High water mark.
Identifiers: *Mineral rights.

Section 179 (56L) authorizes the director of conservation to lease any lands, rights or interests under any navigable waters of the state, including that in the Gulf of Mexico within the seaward boundary of the state (six leagues from the land bordering the gulf) for the purpose of exploration, development, and production of oil, gas, and other minerals. The department of conservation shall supervise and manage such lands and interests. (Sissoner-Fla)
W69-01971

WELLS, CISTERNS: CARE OF.

Ala Code, tit 37, sec 501 (1958).

Descriptors: *Alabama, *Legislation, Wells, *Well screens, Well regulation, Water wells, Cisterns, Rainwater, Cities, *Mosquitoes, Insects, Drains, Stagnant water, Weed control, Weeds, Surface drainage, Surface waters.
Identifiers: Liens.

All cities and towns of the state have the power to construct, repair, and regulate public wells and cisterns. The cities and towns also may compel screening of all wells, cisterns, and other places in such cities and towns where water is collected and mosquitoes or other insects are apt to propagate. The cities and towns are further empowered to compel the proper setting of gutters so as to prevent stagnant water from collecting, and to require weeds to be cut or other things or conditions favorable to the harboring of such insects to be abated. All such work is to be done at the expense of the owner, and if it is not collected a lien will be imposed on the property. (Watson-Fla)
W69-01972

RIGHT OF WAY FOR WATER FLOW CITY CAN ACQUIRE THROUGH EMINENT DOMAIN CONDEMNATION.

Ala Code, tit 37, secs 508 and 510 (1958).

Descriptors: *Alabama, *Legislation, *Cities, Eminent domain, *Right-of-way, Water supply, Sewerage, Drainage, Condemnation, Damages, Judicial decisions.

Whenever the city deems it necessary it can acquire a right of way through private property to obtain a water supply, or for sewage or drainage purposes. The mayor is authorized to purchase the land, or if that is not possible, to acquire by condemnation proceedings. When an appeal is taken by the landowner from a condemnation proceeding it does not deprive the city from entering onto the land for the purposes of the condemnation if all damages have been paid into court and a bond of twice the damages has been given.
W69-01973

SEWERS, DRAINAGE, ETC - GENERAL PROVISIONS.

Ala Code, tit 37, secs 601-607 (1958).

Descriptors: *Alabama, *Legislation, *Sewerage, Sewage disposal, Cesspools, Septic tanks, Sewers, *Cities, Drainage systems, Plumbing, Eminent domain, Surface runoff, Ditches, Sanitary engineering, Storm drains, Canals, Aqueducts, Easements, Channels.

The power to construct and maintain sewers, drainage ditches, canals, etc within and without their boundaries is given to all cities and towns of the state. This power includes the taking of private property when just compensation is first made. The city can extend its sewer system to any point within

the county in which it is situated using the power of eminent domain. It can also compel a landowner to drain his land at his own expense. If the landowner does not comply the city can drain the land itself and impose a lien on the property. The city also has the power to prescribe construction standards for plumbing. It may order private or public premises to connect with the city sewer system. If the owner does not comply the city may make the connection at its own expense and impose a lien on the property. Notice must be given to the property owners before any of the above powers are exercised. Notice to non-residents shall be by publication. (Watson-Fla)
W69-01974

MICHIGAN LAWS RELATING TO WATER.

Joint Committee On Water Resources Planning, Lansing, Michigan; Legislative Service Bureau, Lansing, Michigan.

Legislative Service Bur P. No. 42, 415 pp, 1966, Michigan Laws Relating to Water, pp 1-415, 1966. 415 p.

Descriptors: *Michigan, Legislation, *Water resources management, Watershed management, *Administration, Water management (Applied), *Administrative agencies.

This is a complete compilation of all Michigan laws relating to water resources management. Some statutes, such as those on sports fishing licensing, while they do deal with water in a limited sense, were excluded. This compilation was prepared for the Michigan Legislature's Joint Legislative Committee on Water Resources Planning. Some historical notes and cross references are included. Statutes on local government, Great Lakes cooperation, drainage, the Waterways Commission, the Departments of Conservation and Public Health, water and power companies, among various others, are included.
W69-01980

PROPOSALS FOR STUDYING THE FEDERAL STATE WATER RIGHTS PROBLEM.

Los Angeles Department of Water and Power, Rex B. Goodcell, Jr.

Journal of the American Water Works, Vol. 55, No. 8, August 1963, pp 957-961, 3 ref, 1 appendix.

Descriptors: Water supply, *Federal-state water rights conflicts, Federal jurisdiction, Water law, Water resource development, Legal aspects, Local governments, Interagency cooperation, State governments, *Water rights, Preferences, Appropriable waters, *State jurisdiction, Legislation. Identifiers: Federal water rights, Agency bill, Desert Land Act.

If the claims of those supporting the federal view are sustained, and water originating on federal lands which constitute the major watersheds of the western states is owned and under the control of the federal government, then most of the so-called existing water rights and the water rights under state laws to appropriate and develop unappropriated waters will be subordinate to federal development and use of water. As long as there are legal questions as to water rights, such questions will result in costly litigation, and needed water development by local, state, and federal authorities will be unnecessarily burdened. If needed water development is to proceed there must be maximum cooperation between federal, state, and local water interest. There must be a clarification of states rights over federal rights; and the provision for existing water rights under state laws and protection of recognition of state law to develop water for beneficial use. (Gargola-Chicago)
W69-01981

ALLIANCE FOR CONSERVATION OF NATURAL RESOURCES IN PINELLAS COUNTY V FUREN (APPEALING DECISION OF NAVIGATION AUTHORITY ALLOWING FILL OF PORTION OF BAY).

110 So 2d 55-68 (1959) 14 p.

Descriptors: Judicial decisions, *Florida, Conservation, *Administrative agencies, Natural resources, Navigation, Water control, Bays, *Landfills, Bulkheads.

This case is in the district court on appeal from a decision of the circuit court affirming the issuance of a permit by the County Water and Navigation Control Authority for the fill of a portion of Boca Ciega Bay in Pinellas County. The district court affirmed on the same ground, i.e. that the authority was given wide discretion in the issuance of permits and if there is substantial evidence to support the decision it will not be changed. The authority's discretion will not be limited unless there is an abuse of this discretion. There was substantial evidence to support the findings of the county water and navigation control authority with respect to the beneficial effect of issuing the permit to fill a portion of the bay. (Watson-Fla)
W69-01990

CULLEY V PEARL RIVER INDUS COMM'N (CONSTITUTIONALITY OF CONSTRUCTION OF LARGE DAM AND RESERVOIR).

108 So 2d 390-409 (Miss 1959). 20 p.

Descriptors: Judicial decisions, *Mississippi, *Reservoirs, Watersheds (Basins), *Dams, Rivers, Water supply, Water districts, Riparian land, Condemnation, Eminent domain, Recreation facilities, Legislation, Navigable waters, Tidal waters.
Identifiers: Constitutional law.

Some residents of the area affected brought suit to declare the act creating the Pearl River Valley Water Supply District unconstitutional. The purpose of the act was the construction of a large dam and reservoir covering lands in parts of 5 counties. The Supreme Court of Miss upheld the act. The court stated that because the chancery court was empowered to determine if the project was feasible and would meet a public need, the act was not unconstitutional as conferring on the judiciary authority to decide legislative questions. Also the act did not violate constitutional prohibition against the legislature's passage of local, private, or special laws. Constitutional provision prohibiting the legislature from authorizing permanent obstruction of any navigable waters of the state must be construed in accordance with the meaning of the phrase 'navigable waters' at the time the constitution was adopted. It was then well established that a river was navigable in the technical sense as high up from its mouth as the tide flowed. Statutory definition of navigable waters does not effect the meaning in the constitution, and what constitutes navigable waters is a question of local and not federal law. (Watson-Fla)
W69-01991

DUVAL V THOMAS (RIGHT TO REASONABLE USE OF LAKE SURFACE).

107 So 2d 148-153 (2 DCA Fla 1968).

Descriptors: *Ownership of beds, *Riparian rights, Riparian land, *Water rights, Water utilization, Non-navigable waters, Lakes, Recreation, Reasonable use, Remedies, Landfills, Water law, Legal aspects, Boundaries (Property), Beds, *Florida.

The plaintiff and the two defendants owned property adjacent to and partially covered by a small lake. Defendant A filled a portion of the lake covering his property and defendant B erected a fence in the lake along his property line. These actions effectively cut off the plaintiff's ingress and egress to the main body of the lake. The question presented is whether the owner of a portion of the bed of a non-navigable landlocked lake has the right to exercise

exclusive dominion and control over that portion of the bed and the waters of the lake which he owns. The court decided that the landowner only has the right to make reasonable use of the land and water and when ones lawful use is unreasonably interfered with, the owner of riparian rights has the remedy of injunction. The defendant's use was held to be an unreasonable interference in this instance and the plaintiff was entitled to an injunction to protect his riparian rights. (Horner-Fla)
W69-01992

ANDERSON V U S (CLAIM FOR DAMAGES TO FARM LANDS ALLEGEDLY CAUSED BY ESTABLISHMENT OF WILDLIFE REFUGES).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01993

JONES V UNITED STATES (RUNOFF DAMAGE).
175 F Supp 182-184 (Ct Cl 1959).

Descriptors: Judicial decisions, United States, *Alleviation of flow, Overflow, Flood damage, Embankments, Culverts, Drainage, Erosion, Topsoil, Surface water, Streams, Rivers, Runoff, Rainfall, *Mississippi.

Plaintiff alleges that the construction of a road on a 6 foot embankment and the installation of culverts beneath this embankment diverted the natural flow of the surface water and resulted in the inundation and erosion damage to his cultivated field. Although plaintiff was unable to prove that the culvert location changed the course or increased the natural drainage, it was shown that the use of culverts concentrated the surface water so that it emptied onto plaintiff's land at one point rather than many. This resulted in a discharge of water at a higher velocity than before and caused the erosion of topsoil and the water to stand at a greater depth. Judgment was for the plaintiff. (Childs-Fla)
W69-01994

ATTORAM REALTY CORP V TOWN AND COUNTRY BUILDERS, INC (DAMAGE FROM DISCHARGING SURFACE WATERS).
For primary bibliographic entry see Field 04A.
For abstract, see .

W69-01995

RUSKIN BROS, INC V STATE (DEBRIS BLOCKAGE OF CATCHBASIN).
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-01996

GAGNER V CARLSON (RIGHTS APPURTE-NANT TO FLOWAGE EASEMENT).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01997

LEATHERSICH V NEW YORK STATE WATER RESOURCES COMM'N (ADMINISTRATIVE DECISIONS).
293 NYS 2d 787-791 (Sup Ct 1968).

Descriptors: *New York, *Administrative agencies, Legislation, Ownership of beds, *Land fills, Recreation, Fishing, Lakes, Riparian land, Water law, Legal aspects, Administrative decisions.
Identifiers: Evidence.

The petitioner, representing a sportsmens association sought to reverse the decision of the water resources commission allowing landowner to fill a portion of a lake bed. The petitioner contended that the decisions of the commission made pursuant to a hearing must be supported by substantial evidence. The court upheld the commission's decision because it was not arbitrary or capricious and

substantial evidence was not necessary. (Horner-Fla)
W69-01998

CROLEY V DE WITT (OBSTRUCTION OF DRAIN).

431 S W 2d 657-660 (Ct App Mo 1968).

Descriptors: *Artificial watercourses, *Watercourses (Legal), *Drains, *Obstruction to flow, Natural flow doctrine, Repulsion (Legal aspects), Dams, Floods, Flooding, Riparian rights, Channels, Water law, Legal aspects.

The defendant blocked an artificial channel which caused the plaintiff's land to be flooded. The Plaintiff sought to restrain the defendants' blocking of the drain. The defendant contended that since the drain was artificial it could be blocked under the common enemy doctrine. The court rejected the doctrine and held that the defendant could not obstruct the drain, whether natural or artificial, to the plaintiff's detriment. (Horner-Fla)
W69-01999

FARNES V LANE (EASEMENT TO LAKE).

161 N W 2d 297-301 (Minn 1968).

Descriptors: *Easements, *Riparian rights, Riparian land, Real property, Right-of-way, Lake shores, Lakes, Land use, Land tenure, Docks, Piers, Water law, Legal aspects, *Minnesota.

The defendants had a right of way easement across the plaintiff's lakeshore property. The plaintiff sought a declaration that the easement was for access to the lake only and that the defendant could not build a dock or store personal property on the easement area. The court held that the plaintiff had the burden of proving the use of the easement to be improper. Riparian rights are incident to an estate in land and an easement is not an estate so riparian rights are not necessarily inherent in an easement. The case was remanded to the trial court for a determination of whether the grantor of the easement intended to give riparian rights. (Horner-Fla)
W69-02000

NORTH DADE WATER CO V ADKEN LAND CO (INJUNCTIVE RELIEF FROM DRAINING OF EFFLUENTS INTO PRIVATE LAKES).

For primary bibliographic entry see Field 05B.

For abstract, see .

W69-01948

6F. Nonstructural Alternatives

KRUPA V FARMINGTON RIVER POWER CO (FLOODING BELOW DAM).

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01927

PLAN FOR FLOOD DAMAGE AT BRISTOL, TENNESSEE-VIRGINIA.

Flood Study Committee, Bristol, Tennessee, Bristol, Virginia.

Clarence B. Kefratt, Jr., Maurice Conn, and Richard C. Horner, Jr.
1962, 4 tab, 9 plates.

Descriptors: *Flood plain management, Channel improvement, Flood damage, Flood plain zoning, Non-structural alternatives, Levees, Flood protection, Historic flood, Maximum probable flood, *Detention reservoirs, *Local governments, Project purposes, Land use, Regional floods.
Identifiers: Bristol (Tennessee), Bristol (Virginia), Mumford Creek, Beaver Creek.

Outlined is a possible flood control program for Bristol, Tennessee-Virginia. A review of past flooding, with reference to magnitude and frequency is given. Evacuation of the flood plain, levees, creek diversion, and diversion tunnels are considered as possible alternatives but rejected for various reasons. The conclusion and recommendations suggest construction of two detention reservoirs and channel enlargement. Other aspects of flood management are also considered. Relation of urban renewal projects to the overall flood damage prevention program is considered and particular possibilities listed. Criteria for regulations for flood plain zoning are discussed and a model ordinance presented. An extensive discussion of possible flood proofing alternatives is put forth and recommendations for assistance to individual property owners given. The proposed reservoir project is analyzed, and the cost-benefit ratio shown to be favorable. (Gargola-Chicago)
W69-01979

07. RESOURCES DATA

7A. Network Design

THE USE OF A SQUARE GRID SYSTEM FOR COMPUTER ESTIMATION OF PRECIPITATION, TEMPERATURE, AND RUNOFF,
Shawinigan Engineering Co., Ltd., Montreal, Quebec, Canada, and James F. McLaren, Ltd., Montreal, Quebec, Canada.

For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01607

A SYSTEM FOR MEASURING CONDUCTIVITY, ACIDITY, AND RATE OF WATER FLOW IN A FOREST SOIL,
Washington Univ., Seattle.
Dale W. Cole.
Water Resources Res, Vol 4, No 5, pp 1127-1136, Oct 1968. 10 p, 10 fig, 13 ref.

Descriptors: *Network design, *Data processing, *Lysimeters, *Hydrologic data, *Soil water, Soil chemistry, Soil water movement, Computers, Washington.

Identifiers: Seattle (Washington), Tension lysimeters.

A system for collecting, recording, and analyzing forest soil water movement and quality data is described. The system is in operation on a lower terrace of the Cedar River watershed of the City of Seattle water supply. Tension lysimeters, consisting of fused aluminum oxide disks 11 in. in diameter are installed so that overlying soil and root systems are not disturbed. The collected water passes through flow cells which measure conductivity, acidity, and flow rate. The flow rate cell is sensitive to rates as low as 0.002 cm/hr. The collected data are automatically punched on paper tape and converted to tabular and graphic form in a computer. Examples of the system's output are presented. A flow diagram of the computer program is included. The data collected are particularly useful in studying ionic transport in soil to aid in understanding soil development, mineral-plant relationships, and land management practices. (Knapp-USGS)
W69-01643

7B. Data Acquisition

INFLUENCE OF THE PHYSICAL AND CHEMICAL PROPERTIES OF SOIL ON MEASUREMENTS OF WATER CONTENT USING NEUTRON PROBES,

For primary bibliographic entry see Field 02G.
For abstract, see .
W69-01616

Field 07—RESOURCES DATA

Group 7B—Data Acquisition

THE STEADY-STATE MEASUREMENT OF THE RELATION BETWEEN HYDRAULIC CONDUCTIVITY AND MOISTURE CONTENT IN SOILS.
Sydney Univ., N. S. W., Australia.
D. E. Smiles, and G. D. Towner.
Water Resources Res, Vol 4, No 5, pp 1029-1030, Oct 1968. 2 p, 3 ref.

Descriptors: *Soil moisture, *Hydraulic conductivity, *Mathematical studies, Darcys law.
Identifiers: Soil moisture-hydraulic conductivity relationships.

A simple mathematical method is proposed to use with steady state head measurements to determine the relation between soil hydraulic conductivity and soil moisture content. The use of finite difference approximations to the Darcy flow equation is not necessary. The method requires the performance of a series of steady state infiltration experiments with different values of fluid flow rate and potential gradients. The simple experimental procedures to eliminate membrane impedance is suggested. (Knapp-USGS)
W69-01625

A SYSTEM FOR MEASURING CONDUCTIVITY, ACIDITY, AND RATE OF WATER FLOW IN A FOREST SOIL,
Washington Univ., Seattle.
For primary bibliographic entry see Field 07A.
For abstract, see .
W69-01643

FLUID FLOW MEASUREMENT.
For primary bibliographic entry see Field 08B.
For abstract, see .
W69-01658

MONITORING STORM-WATER OVERFLOWS.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-01664

NEW INSTRUMENT CAN MEASURE SEWAGE FLOW,
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-01665

RESULTS OF RADAR MEASUREMENTS OF LIQUID PRECIPITATION,
A. M. Dimakyan, and N. V. Zotimov.
Am Geophysical Union, Soviet Hydrology-Selected Papers, No 6, pp 530-7, 1965.

Descriptors: *Rainfall intensity.
Identifiers: *Radar measurement.

Correlations exist between strength of radio echo signals and rate of precipitation; confirmation is given that differential calibration of radar installation makes it possible to measure intensity of rainfall irrespective of its nature during season or in different years, and that method may be applied to any type of radar station; curve of sensitivity of radar installation in relation to characteristics of rainfall is given.
W69-01666

TOTAL FLOW MEASUREMENT IN SEWERS AND DRAINS,
M. H. Diskin.
ASCE Proc, J of Hydr Div, Vol 89, No HY4, Part 1, July 1963.

Descriptors: *Flow measurement, *Sewers, *Discharge measurement, Instrumentation.

Temporary flow measurement in circular channels, such as sewers and drains, as well as in sewers of other cross sections, can be carried out by in-

troducing into the flow a pier-shaped element with a bottom rounded to fit the circular invert of the channel. The reduction in the area of flow causes a critical section to develop in the throat so formed, which gives a functional relationship between the discharge and the critical depth at the throat and also between the discharge and the depth at an upstream section adopted as a measuring section. The device is, in effect, a critical depth flume, or a Venturi flume, with an irregularly shaped throat composed of 2 openings on either side of the element introduced. Applying the theory of critical depth flumes, equations are derived relating the discharge to depth at the measuring section; the equations are solved numerically, making use of standard tables of properties of parts of a circle. The results of experiments performed on the proposed measuring device indicate fairly close agreement between the measured and the calculated rates of flow, most values of the coefficient of discharge falling in the range of 0.90 to 1.00. The experiments included tests on 4 measuring devices, 2 in each of 2 circular channels 10 in. and 16 in. diameter.
W69-01667

A FIELD METHOD OF MEASURING AND RECORDING FLOW IN SEWERS,
Warren Ellis, and C. Thorne Johnston.
Pub Works, Vol 94, June 1963.

Descriptors: *Sewers, *Flow measurement, Manholes, *Velocity, Roughness (Hydraulic), *Instrumentation.

A method of measuring and recording flow in sewers is given as follows. Determine the size, length, and slope of a sewer between 2 manholes. For known depths of flow in this sewer determine velocities between the upper and lower manholes by using dye test and stop watch. From the velocity data determine roughness coefficient 'n' through the Manning formula. Prepare a depth-discharge curve for the particular stretch of sewer. Using a stage recorder, continuously record the depth of flow in the sewer for desired period, and convert the depth data to flow rate. A portable, spring-wound stage recorder is used. A special ring to hold a bubbler tube with the tube opening at the sewer invert is mounted inside the sewer. Nitrogen gas from a bottle is bubbled through the tube, and the gas pressure required to discharge the gas beneath the liquid is recorded as depth of flow on the recorder chart. The special equipment used is described and illustrated. Costs of equipment are listed.
W69-01668

REPORT OF U. S. WEATHER BUREAU STUDIES IN RADAR HYDROLOGY,
A. F. Flanders.
Int Geodetic and Geophysical Union-Sec for Sci Hydrology Publ No 65, pp 360-71, 1964.

Descriptors: *Rain gages, Instrumentation.
Identifiers: *Radar measurement.

Progress made by U S Weather Bureau on measurement of precipitation by WSR-57 radar is presented; various operational attempts, techniques and applications made in field of radar-hydrology show successes and limitations encountered as well as progress made with Radar Precipitation Integrator; plans for utilization of radar as continuous recording rain gage as step toward automation in radar-hydrology-computer area.
W69-01671

ADJUSTMENT OF RADAR ESTIMATES OF STORM MEAN RAINFALL WITH RAIN GAGE DATA,
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-01673

DISPOSAL OF MUNICIPAL SEWAGE (WATER POLLUTION CONTROL AND ABATEMENT).
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-01724

REMOTE CONTROL GROUTING OF SEWER LINE LEAKS,
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-01748

PING-PONG BALLS WILL TRACE POLLUTION.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-01762

ECONOMICS OF URBAN DRAINAGE DESIGN,
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01771

A METHOD OF COMPUTING URBAN RUNOFF,
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01884

PROGRESS REPORT (STUDY OF RATIONAL METHOD),
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01894

ANALYSES AND APPLICATION OF SIMPLE HYDROGRAPHS,
H. N. Holtan, and D. E. Overton.
J Hydrology, Vol 1, No 3, pp 250-64, 1963.

Descriptors: *Hydrographs, *Watersheds, *Rainfall intensity, Storms.

Method of hydrograph analyses to derive parameters for computing hydrographs tailored to specific watersheds and specific rainstorms; simple hydrographs are analyzed to develop techniques for rapid derivation of watershed storage coefficient, and subsequently, for defining and positioning hydrograph in terms of storage coefficient and rainfall intensity period; simple hydrographs are developed by these techniques for storm increments or for homogeneous increments of heterogeneous watersheds, and summed to derive complex, multiple-peak, or sustained-flow hydrographs.
W69-01913

MEASURING RAINFALL AND RUN-OFF AT STORM-WATER INLETS,
J. W. Knapp, J. C. Schaake, and W. Viessman.
ASCE Proc, J of Hydr Div, Vol 89, No HY5, p 99, 1963.

Descriptors: *Rainfall-runoff relationships, *Rain gages, Intakes, Instrumentation, *Automatic control, Storms, *Runoff, *Storm runoff.
Identifiers: *Urban drainage.

An illustrated description is given of an instrument system which has been developed to measure rainfall and run-off in small urban drainage areas draining to storm-water inlets. The system includes a rain gauge on each area, a measuring device inside the inlets, a recorder, and controls providing automatic operation during storms. The installation can be completed with few alterations to existing drainage facilities.
W69-01923

Evaluation, Processing and Publication—Group 7C**7C. Evaluation, Processing AND Publication****GEOLOGIC FACTORS IN COMMUNITY DEVELOPMENT AT NAPERVILLE, ILLINOIS, Illinois State Geological Survey, Urbana.**
For primary bibliographic entry see Field 03B.

For abstract, see .

W69-01594

THE USE OF A SQUARE GRID SYSTEM FOR COMPUTER ESTIMATION OF PRECIPITATION, TEMPERATURE, AND RUNOFF,
Shawinigan Engineering Co., Ltd., Montreal, Quebec, Canada, and James F. MacLaren, Ltd., Montreal, Quebec, Canada.
S. I. Solomon, J. P. Denouvillez, and E. J. Chart.
Water Resources Res, Vol 4, No 5, pp 919-929, Oct 1968. 11 p, 5 fig, 2 tab, 5 ref.

Descriptors: *Data processing, *Digital computers, *Networks, Data storage and retrieval, Data transmission, Meteorological data, Hydrologic data, Synoptic analysis.

Identifiers: *Drainage basin characteristics, Newfoundland, Square grid data matrices.

Water resource studies in recent years have had a tendency to encompass larger areas. The increase in size and sophistication of these studies makes the use of computers very desirable to save time and increase accuracy. The study area must be converted to a schematic representation which is easily manageable by computers. A simple way of doing this is to cover the study area with a square grid, which may then be treated as a matrix of squares. This system can be used to store, process, and retrieve information in the fields of hydrology, hydraulic power, and economics. The application of the square grid system to the estimation of the precipitation, temperature, and runoff distribution in a large area is demonstrated. Use of the system enables efficient combination of the meteorologic and hydrologic information available in studying the precipitation, temperature and runoff distribution. An example of such a computation for a 43,000-square-mile area is given and the advantages of the method over the usual techniques are discussed. (Knapp-USGS)

W69-01607

UNIFORM FLOOD-FREQUENCY ESTIMATING METHODS FOR FEDERAL AGENCIES, U S Geological Survey, Washington, D. C.
Manuel A. Benson.

Water Resources Res, Vol 4, No 5, pp 891-908, Oct 1968. 18 p, 1 fig, 6 tab, 5 ref.

Descriptors: *Floods, *Statistical methods, *Frequency analysis, Data processing, Flood protection, Rivers.

Identifiers: *Flood frequencies, Flood-plain management, Log-Pearson Type III method.

Large-scale planning for improved flood-plain management and expanding water-resources development makes increasingly important a consistent approach to estimation of flood frequencies. The most commonly used methods of flood-frequency analysis were studied and the results of applying these methods to a selected group of long-record representative sites in different parts of the country were compared. It is recommended that all government agencies adopt a uniform procedure for flood-frequency analysis at sites where records are available. The log-Pearson Type III distribution was selected as the basic method, with provisions for departures if justified. Further study leading toward improvement or revision of methods is recommended. (Knapp-USGS)

W69-01609

GEOPHYSICAL LOG CROSS-SECTION NETWORK OF THE CRETACEOUS SEDIMENTS OF SOUTHERN MARYLAND,
U. S. Geol Surv., Washington, D. C., Water Resources Div.
Harry J. Hansen, III.
Maryland Geol Surv Rep of Invest No 7, 46 p, 1968. Test, 8 fig, 17 plate, 7 tab, 1 append, 67 ref.

Descriptors: *Stratigraphy, *Hydrogeology, *Electrical well logging, *Radioactive well logging, *Cross-sections, Geologic formations, Palynology, Sampling, Maryland.

Identifiers: Southern Maryland, Stratigraphy, Holes.

Cross sections and maps were prepared, using electric logs, gamma-ray logs, and published stratigraphic data for groundwater oriented studies in Southern Maryland. The correlation network consists of 4 cross sections subparallel to the strike of the Cretaceous formations and 12 cross sections subparallel to the dip. Correlation is based on geophysical (electric and gamma ray logs) and lithological data; selected well samples were studied palynologically. This network suggests that groups of sands, such as those comprising the Patuxent Formation, can be correlated along strike in the Anne Arundel-Prince Georges County area for distances exceeding 20 miles. This is not compatible with a concept of individually isolated, channel or 'shoestring' sands. Sand counts indicate that both the Patuxent and the Raritan-Patapsco Formation (undivided) exhibit a southerly decrease in sand percentage. In the Anne Arundel-northern Prince Georges County area these formations contain greater than 45% sand; in Charles County sand percentages characteristically are less than 30%. The mottled clays associated with these sediments change form predominantly red-brown in the north to predominantly gray-green in the south. (Knapp-USGS)

W69-01638

THE RESPONSE OF WATER TEMPERATURES TO METEOROLOGICAL CONDITIONS,
Vanderbilt Univ., Nashville, Tenn; Office of the Surgeon, Headquarters, U. S. Army Vietnam; and Johns Hopkins Univ., Baltimore, Maryland.
For primary bibliographic entry see Field 02D.

For abstract, see .

W69-01642

APPLICATION OF THE DIGITAL COMPUTER FOR AQUIFER EVALUATION,
Nova Scotia Department of Mines, Halifax, and U. S. Geological Survey.
George F. Pinder, and J. D. Bredehoeft.
Water Resources Res, Vol 4, No 5, pp 1069-1093, Oct 1968. 25 p, 18 fig, 53 ref.

Descriptors: *Computer models, *Digital computers, *Computer programs, *Unsteady flow, *Aquifers, Aquicludes, Analog models, Pump testing, Aquifers characteristics, Hydrogeology, Water levels.

Identifiers: Finite difference method, Pumping tests.

A digital computer program was written to solve linear, parabolic, partial differential equations of unsteady state flow in confined aquifers by an implicit finite difference technique. The program was checked by calculating solutions for problems described by known analytical functions and solved by electrical analog. The calculated and analytical values compared favorably. An aquifer at Musquodoboit Harbour, Nova Scotia was analyzed; aquifer parameters in the digital model were modified to fit computed results to pump-test data. The results were compared to an electric analog solution and the results were in good agreement. (Knapp-USGS)

W69-01646

THE INTERNAL DISTRIBUTION OF ANALYSIS VALUES AS AN INDICATOR OF EUTROPHICATION,
Michigan Univ., Ann Arbor, Great Lakes Res Div, Inst of Science and Tech.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-01650**PROGRESS REPORT OF THE STORM DRAINAGE RESEARCH PROJECT,**
Johns Hopkins Univ., Baltimore, Md. Dept. Sanit. Eng. and Water Resources.
For primary bibliographic entry see Field 08B.
For abstract, see .
W69-01659**COMPUTERS TO CONTROL COMBINED SEWERS.**
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01716**STORM SEWER DESIGN AND ANALYSIS BY COMPUTER.**
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01757**SURFACE WATER DRAINAGE CALCULATION BY DIGITAL COMPUTER.**
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01782**HOW TO ESTIMATE STORM WATER QUANTITIES,**
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01785**THREE-DIMENSIONAL TYPE REPRESENTATION OF HYDROLOGICAL DATA,**
A. A. Hirsch.
AWWA-J, Vol 56, No 7, p 937, July 1964.

Descriptors: *Rainfall-runoff relationships, *Data collections.

Three-dimensional method of presenting time-related values for data related to rainfall, streamflows, water levels, etc, so that 1-yr graphs can be compared over periods of many years; method whereby yearly curves are cut-out, laminated in clear plastic, and mounted in plots on baseboard, for furnishing easily comprehensible volume of data in compressed form.

W69-01912

RAINSTORMS MADE TO ORDER,
L. Arthur Hoyt.
Pub Works, Vol 99, No 3, pp 95-98, March 1968. 4 p, 1 fig, 2 photo.

Descriptors: *Computer programs, *Storms, *Rainfall intensity, Watersheds, *Storm runoff.

A computer controlled rainfall simulator has been developed by Ven Te Chow of the University of Illinois to produce artificial rainstorms. The simulator can develop storms of any intensity pattern, repeat them at any interval desired over all types of terrain, and measure runoff from the terrain with given conditions of absorption and other parameters, to an accuracy never before obtainable. The rainfall can be released over any part, or all, of a 40- by 40-ft artificial terrain. Types of storms are programmed and stored on computer tape so they can be started, stopped, or repeated at will. The terrain simulated can range from lush water basin areas to arid desert. Water runoff is accurately measured. Major objective of the entire study is to

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investigate basic laws of flow mechanics of surface water over artificial watersheds. Descriptions of the electronic simulator and operation of major components are given.
W69-01914

DISSIPATIVE RIVER FLOW MODEL,
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01917

CALCULATION OF DISCHARGE OF RAIN DITCHES AND RAINFALL COLLECTING SYSTEMS,
G. Jeuffroy, and J. Prunieras.
Construction, Vol 19, No 1, pp 21-9, Jan 1964.

Descriptors: *Discharge (Water), *Storm drains, Rivers, Runoff forecasting.
Identifiers: *Calculations.

Calculation of discharge of rain ditches and rainfall collecting systems; method for calculating maximal flow of ditch or surface channel bordering elongated area, taking into account local meteorological factors and discharge rate of drainage system; variable discharge rate is stated by equation with partial derivatives where integration provides simple solution for flow at arbitrary time and point; theory applicable to flood levels on rivers.
W69-01918

LINEAR ANALYSIS OF RAINFALL-RUNOFF RELATIONSHIP,
V. C. Kulandaiswamy.
Instn Engrs (India)-J, Vol 46, No 11, pt Ci 6, pp 594-603, July 1966.

Descriptors: *Rainfall-runoff relationships, *Hydrographs.
Identifiers: *Calculations.

Study of relationship between rainfall excess and surface runoff by treating rainfall excess as 'inflow to' and surface runoff as 'outflow from' basin, and assuming relationship to be linear; using Laplace transform method, expression is derived for instantaneous unit hydrograph; various assumptions underlying existing instantaneous unit hydrograph theories and approximations made in their development are explained.
W69-01924

A BASIC STUDY OF THE RAINFALL EXCESS-SURFACE RUN-OFF RELATIONSHIP IN A BASIN SYSTEM,
V. C. Kulandaiswamy.
Thesis, Univ of Illinois, 1964.

Descriptors: *Rainfall-runoff relationships, *Hydrographs, Drainage, Storms, *Surface runoff.
Identifiers: *Calculations.

After reviewing various instantaneous unit hydrograph theories, the author develops a general theory for the relation between rainfall and run-off in a drainage basin. An equation is first derived for storage in the basin, and this equation is then combined with the equation of continuity to give the differential equation for the system. The theory is valid for both linear and non-linear cases. Storms over 6 natural basins were analysed to verify the theory; the storage and surface run-off computed agreed well with observed values.
W69-01925

EXTENDED TABLES OF THE TRANSFORMATION (PHI = (2) (ARCSIN SQUARE ROOT X)),
Canada Fisheries Research Board, Nanaimo, British Columbia.
J. R. Dryburgh, J. A. Thomson, and D. F. Alderdice.
Tech Rept 45 Dec 1967. 23 p.

Descriptors: *Data processing, *Statistics, Computers, Bioassay.
Identifiers: *Arcsin transformation, *Angular transformation, Variance stabilization, Tables.

Authors present tables of computer-generated values to four significant decimals of the transformation, Phi = (2) (arcsin square root X), for arguments of X from 0.0001 to 0.9999 in increments of 0.0001. The transformation has been commonly used to stabilize variance of data presented in the form of proportions, as in some bioassay trials.
(Wis)
W69-01975

08. ENGINEERING WORKS

8A. Structures

HYDRAULIC DESIGN OF STORM SEWAGE OVERFLOWS INCORPORATING STORAGE,
P. Ackers, A. J. M. Harrison, and A. J. Brewer.
Instn Mun Engrs J, Vol 95, No 1, pp 31-7, Jan 1968.

Descriptors: *Overflow, *Hydraulic design, Weirs, Storm runoff.
Identifiers: *Storage tank, Capacity.

Consequences of designing storm overflows to spill all discharges over set value, regardless of dynamic behavior of storm flow, are considered; it is concluded that it is desirable to avoid spilling first part of storm wave and method of calculating its volume is presented; necessary volume of storage tank to contain flush downstream of overflow weirs is considered; equations describing rate of rise of level in tanks of rectangular and circular cross-sections are solved for case of uniformly increasing rate of inflow within range of overflow settings; design example is given on calculation of volume of tank for overflow.
W69-01678

PRELIMINARY GUIDANCE FOR THE CALCULATION AND DESIGN OF STORM-SEWAGE OVERFLOWS IN COMBINED SEWAGE SYSTEMS.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01682

KENT SEWERAGE WORKS FOR 9000 PEOPLE.

Munic Eng, Lond, Vol 142, p 1803, 1965.

Descriptors: Overflow, Storm runoff.
Identifiers: *Storage tanks.

A description with plan is given of improvements planned by Eastridge R.D.C., Kent, to the sewerage system for St. Nicholas-at-Wade, Monckton and Minster. The existing treatment plant at Minster, which provides complete treatment by biological filtration, is to be enlarged to deal with a dry-weather flow of about 300,000 gal per day. Storm-water tanks will receive flows of from three to six times the dry-weather flow.
W69-01683

SKIPTON-SILSDEN SEWERAGE FINISHED AHEAD OF SCHEDULE.

Munic Eng, Lond, Vol 140, p 1344, 1963.

Descriptors: *Storm runoff, *Overflow, Sedimentation, Weirs.
Identifiers: Storage tanks.

In a recently completed joint sewerage scheme for Skipton rural district and Silsden urban district, Yorks., all the sewage from the area will be conveyed to the Keighley disposal works by an exten-

sion of the Keighley sewers up the Aire valley. Six small sewage works will be abandoned, but at Silsden and Stelton storm water will overflow to sedimentation tanks at the old works before discharge to the river Aire. There are also five overflow weirs on existing sewers with direct discharges to the nearest watercourse. A pumping station on the site of the Kildwick works will pump sewage from Farnhill and Kildwick across the river Aire by a rising main to join the main sewer.
W69-01684

NEWTHORPE, NOTTS., SEWAGE DISPOSAL WORKS.

Surv Munic Cty Engr, Vol 130, No 3923, pp 18-19, 55, 1967.

Descriptors: *Storm runoff, Overflow.
Identifiers: *Storage tanks.

A description, with a flow diagram of treatment facilities and a map of the sewerage area involved, is given of new works to be constructed jointly by Basford R.D.C. and Eastwood U.D.C., Notts. A new sewage works at Newthorpe, designed to treat a flow of 18 m.g.d. by biological filtration with recirculation of effluent, will replace 7 existing works; flows in excess of 18 m.g.d. will pass to 3 storm-water tanks. Primary sludge will be treated by Paxman sludge concentrator units, and humus sludge will be returned to the main inlet.
W69-01685

STORM WATER OVERFLOWS. THE USE OF SIPHONS AT IPSWICH,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01692

DESIGN OF UNDERWATER STORM WATER OVERFLOW STORAGE SYSTEM,

J. S. Blossom.
Piping and Air Condit, Vol 40, No 4, pp 126-30, April 1968.

Descriptors: *Design, *Storm runoff, *Overflow, Runoff, Outlets, *Flow measurement, *Instrumentation.

Identifiers: *Storage tanks, *Combined sewers, *Interceptor sewers, *Suspended solids, *Capacity.

Sequence of operation of underwater storm water overflow storage system using flexible tanks is described; combined sewer carries runoff from drainage area; dry weather flow connection carries normal sanitary flow to interceptor, and overflow sewer carries storm water to river outfall; diversion structure of sewer diverts flow to storage system; incorporated in structure is flume to measure flow; suspended solids analysis of overflow; capacity analysis of underwater storm water overflow storage system, based on 11 yr of rainfall data.
W69-01693

DRAW-DOWN AND OTHER FACTORS RELATING TO DESIGN OF STORM-WATER OVERFLOWS ON SEWERS,

C. D. C. Braine.
J Inst Civ Eng, Vol 28, No 6, pp 136-63, April 1947.

Descriptors: *Storm runoff, *Overflow, Sewers, *Siphons, *Stilling basins, *Drawdown, Design.

Calculations for critical depth and draw-down; description of storm water overflows of restricted flow; stilling pond and siphon types.
W69-01695

HYDRAULIC DESIGN OF DEPRESSED CURB-OPENING INLETS,

W. J. Bauer, and D. C. Woo.
Nat Res Council-Highway Res Bd-Res Rec, No 58, pp 61-80, 1964.

Descriptors: *Hydraulic design, *Intakes, *Highways, Drainage systems, *Storm runoff.

New hydraulic design curves for depressed curb-opening inlets used in highway drainage systems were developed from experimental data; curves cover considerable range of practical conditions and also allow direct comparison of effect of size of depression to efficiency of inlet; sump condition is included that refers to condition that inlet is located at low point of sag vertical curve; application of curves is presented.
W69-01702

DESIGN, CONSTRUCTION AND OPERATION OF SEWER OUTFALLS IN ESTUARINE AND TIDAL WATERS,

Frank L. Heaney.

Water Poll Control Fed J, Vol 32, No 6, pp 610-21, June 1960.

Descriptors: *Estuaries, Design, Construction, *Outlets, Sewers, Standards, Chlorination, *Rainfall intensity, *Overflow, *Water pollution, *Hydraulics, Maintenance.
Identifiers: *Combined sewers, *New York, N. Y., *Urban drainage.

The object of design of outfall sewers was to destroy the physical character of the sewage without objectionable odors, floating solids at shore line, scum accumulations or bottom deposits. Present day standards require, in addition, a reduction of bacterial concentration. In discussing design the author states that shore overflows from plant should be avoided and provisions should be made for emergency chlorination. In New York City experience has shown that 0.02 in/hr rainfall has resulted in discharge of approximately 30% raw sewage from combined sewer overflows. Also that from 70 years of records, one to two rainstorms of over 0.02 inch/hour occur each week during the summer. The receiving waters remain polluted for a period of one to three days after each rainfall. Author discusses location of outfalls, hydraulic considerations, and design of outlet structures. In design the author uses the charts and formulas of Rown and Palmer and shows the theoretical computations of mixing of sewage with sea water. Each area must have tests taken to assess the effectiveness of mixing. The author discusses construction and maintenance of outfall sewers and also costs of same.
W69-01703

STORM WATER TANKS WITHOUT GRADIENTS, A METHOD OF IMPROVING THE SEWERAGE SYSTEMS OF TOWNS,

F. Schimrick.

Gas Wasserfach, Vol 92, pp 156-8, 1951.

Descriptors: *Storm runoff, Design, Pumping.
Identifiers: *Storage tanks, *Urban drainage.

The author discusses the possibility of inserting storm water tanks in sewerage systems. Where the depth of the tank is somewhat less than the internal diameter of the inlet channel, no gradient is necessary. The use of such inserted tanks to reduce the load on pumping plant and sewage works is discussed with examples of their effect in various towns.
W69-01708

DEEP TUNNEL SYSTEM GETS OFF THE GROUND.

ASCE - San Eng Div, Newsletter, pp 7-8, May 1967.

Descriptors: *Tunnels, *Grants, *Sewage lagoons, *Floor control, Instrumentation, *Overflow, Pumping, *Sewage sludge.
Identifiers: *Combined sewers, Chicago (Ill.), *Storage tanks, New York (N. Y.).

Chicago has received a \$1 million grant from FWPCA to help build and demonstrate a \$14,389,600 deep-tunnel system to store the rain-swollen flows in combined sewers in part of the city's northside. When the flow in the combined sewers returns to normal, the water stored in the tunnel will be pumped back into the sewer lines for treatment. Other grants awarded were to: Shelbyville, Ill. to help build a system to hold and treat combined-sewer flows in several holding and treatment lagoons and a holding tank; to New York City to help pay for the installation and evaluation of a siphon-type Ponsar regulator designed to provide better control of the flows from combined sewers into interceptor sewers; and to Columbus, Ohio to help renovate and improve the efficiency of the combined-sewer overflow holding tanks by installing new pumps which will remove sludge which now accumulates and causes odors.
W69-01712

ASCE SEWER PROJECT CONTINUES.

ASCE - San Eng Div, Newsletter, p 5, Jan 1967.

Descriptors: *Pumping, *Equipment, Drainage system.
Identifiers: *Sewer-within-sewer, *Combined sewers, *Urban drainage.

ASCE is continuing to study the sewer-within-a-sewer concept under a new contract. Combination grinder-pump units will be developed for both household and commercial uses. A limited number of these will go into buildings in a demonstration area and be connected to piping installed in existing combined sewers. Tests will be conducted for a six month period. At the same time, plans will be developed for a demonstration in an entire urban drainage area.
W69-01713

COMBINATION SEWER SEPARATED INTO SANITARY AND STORM LINES LOW COST.

Civ Eng, Vol 36, No 5, p 55, May 1966.

Descriptors: Sewers, Pipes, Tunnels.
Identifiers: *Combined sewers, Storm sewers.

Sewer department of Minneapolis, Minn., has recently placed 5700 ft of corrugated steel pipe in bottom of existing combination sewer—for sewage only, to reduce load on treatment plant; Armco Smooth-Flo pipe, 42 in. in diam has asphaltic liner; flattened to 53 x 22.5 in., it fits well into bottom of old 102-in.-diam tunnel; prefabricated bands with neoprene gaskets hold sections together, and corrugated hold-down bands anchor them to tunnel wall; concrete is then placed to prevent line from 'floating' and provide smooth base for storm flow above.
W69-01714

DATA AVAILABLE ON SEPARATING COMBINED SEWERS.

Environ Sci Technol, Vol 2, No 8, p 577, Aug 1968.

Descriptors: *Construction costs, *Overflow, *Storm runoff, Pumping.
Identifiers: *Combined sewers, *Sewer separation, *Storm sewers, *Storage tanks, *Washington, D. C.

The cost of separating the combined storm and sanitary sewers in the United States, which now serve 36 million people, is approximately \$48 billion, according to a recent report prepared by the American Public Works Association for the Federal Water Pollution Control Administration. The report is a national inventory of the effects and means of correcting combined sewer overflows and separate storm and sanitary sewer discharges in the United States. A pilot project to construct two

giant rubberized tanks in the Anacostia River in Washington, D. C. to store overflow during heavy rainfall is also mentioned. Each tank has a capacity of 100,000 gallons and will be anchored in the river bed. During the period of overflow, sewage will be diverted into an on-shore pump house where it will be crushed before being pumped into the tanks. The contents of the tanks will be pumped back into the sewer lines after the storm water recedes.
W69-01715

SEWER SEPARATION.

Water and Wastes Eng, Vol 3, p 2, 1966.

Descriptors: Sewers, *Overflows, Design, *Water pollution.
Identifiers: *Combined sewers, *Sewer infiltration.

Engineers and Superintendents of Sewer systems representing a cross-section of the country were asked several questions regarding their systems. These questions included miles of different-types of sewers, if infiltration was a problem, number and types of regulators and diversions used, design of combined systems and if any bottlenecks, and an estimate of percentage and amount of pollution bypassed each year. Answers indicated that infiltration was a problem in several cities, but the sewage lost from bypassing or overflows was not a significant pollution problem.
W69-01719

SEWER WITHIN A SEWER.

Water Works and Wastes Eng, Vol 1, pp 36-37, 101, Feb 1964.

Descriptors: *Sewers, *Plastic pipes, *Construction, Construction costs.
Identifiers: *Combined sewers, *Ottawa (Canada).

Ottawa, Ont., Can., constructed small gravity sewers inside 2 existing large-diameter combined outfall sewers to convey intercepted sanitary flow to a new main interceptor tunnel. The inner sewer slopes in the opposite direction from the outer sewer, which is accomplished by starting the high end of the inner sewer at the top of the large sewer and spiraling it down the outer sewer wall. In one location because of corrosive wastes the inner sewer consists of 1440 ft. of 15 in. dia. PVC plastic pipe. In the other location the inner sewer is 1303 ft. of 12 in. CI pipe. The 15 in. sewer cost \$20.41 to \$24.41 per ft in place. The sewer within a sewer technique permitted main interceptor modifications that saved an estimated \$1,200,000. When completed, the main interceptor system will consist of 38,300 ft of 72 in. to 96 in. dia. tunnel.
W69-01720

FACTS ABOUT COMBINED SEWER SYSTEMS.

Water and Wastes Eng, Vol 4, No 11, p 78, Nov 1967.

Descriptors: *Combined sewers.

Facts about combined sewer systems are being collected by the American Public Works Association. A \$250,000 grant from the Federal Water Pollution Control Administration has been awarded to the Association, whose representatives will conduct on-site interviews with water officials of about 900 communities with combined sewer systems. All cities with populations over 25,000 will be included in the survey and checks will also be made on 30 percent of smaller communities having this type of system.
W69-01721

DRAINAGE (SEWERAGE).

C E Code of Practice No 5, Instn of Mun Engrs, London, 1950.

Field 08—ENGINEERING WORKS

Group 8A—Structures

Descriptors: *Design, *Sewers, Manholes, *Storm runoff, *Overflow, Siphons, Pumping, *Runoff.

In a Code of Practice intended to indicate what is considered to be good practice in the design and construction of sewerage systems under average conditions, recommendations are made concerning choice of sewerage system, layout, size, shape, depth and gradient of sewers, manholes, storm-water overflows, siphons, pumping stations, pumping mains, tidal outfalls, and other works. Information is given on legislation concerning discharge of trade waste waters to sewers and on the effect of some types of trade waste waters on sewerage systems and on natural waters. In an appendix, a suggested method for calculating run-off is described.
W69-01722

INTERCEPTOR SEWERS,

E. E. Bloss.

Presented at Amer Soc of Civ Engrs Meeting, Oct 18-22, 1965, Kansas City, Missouri.

Descriptors: Design, Pumping, Treatment, *Flow measurement, Hydrographs, Overflow, Storm runoff, *Water pollution control, Hydraulics, Construction costs.

Identifiers: *Interceptor sewers, *Capacity, St. Louis (Mo.), Combined sewers, Sewer infiltration.

Subject matter discussed in this paper on interceptor sewers applies specifically to the design of the interceptor sewers of the Metropolitan St. Louis Sewer District Pollution Abatement Project. The paper includes as background information, a brief description of the District, as well as a brief description of the overall plan of the proposed interception, pumping and treatment facilities. The methods used in gaging present flows are also discussed and a number of measured sewer hydrographs are reproduced. Detailed investigation of the spill of mixed sewage and rainfall with interceptors of several different capacities is discussed in considerable detail leading to the finding that adequate abatement of pollution can be achieved with interceptors having a capacity equal to the peak rate of sewage flow. In this investigation sewage flow was considered to consist of domestic and industrial waste flow only; it did not include ground water infiltration. However, to completely avoid spill during dry weather, it was further concluded that interceptors, in final design, should have a capacity equal to the peak flow of sanitary sewage plus the peak rate of ground water infiltration. Detailed computations of sewage spill were made under conditions of present and assumed ultimate watershed development for interceptors on two of the largest sewers of the District as finally designed. Two typical interceptor structures are discussed and illustrated. Storm water flows for several assumed runoff rates and the effects of such flows on the hydraulics of the trunk interceptor sewer are discussed. Finally, in order to illustrate the disproportionate effect on cost when compared to the small improvement in pollution abatement accomplished by increasing interceptor capacities. The trunk sewer was resized to accommodate 1.25 times peak dry weather flow. A cost estimate of the trunk to carry the larger flow was prepared and compared with the estimated cost of the trunk as designed. The reduction in degree of pollution abatement which would have been achieved by the slightly larger interceptor was also computed and shown to be inconsequential. The economic inadvisability of increasing interceptor capacity beyond one times peak dry weather flow for the St. L
W69-01728

AN EVALUATION OF THE PROBLEMS OF SANITARY SEWER SYSTEM DESIGN,
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-01742

SEWER DESIGN-INFILTRATION DETECTION AND CORRECTION,
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-01744

FLOOD RELIEF PROJECT IN LONDON SUB-URB.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01754

NEW SEWERAGE FOR CROYDON.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01755

BORE DUG IN WET SOIL FLOWS TRICKY PATH.

Const Methods and Equip, Vol 46, No 7, pp 140-2, 145-6, July 1964.

Descriptors: *Tunnel construction, Drilling equipment.

Identifiers: Storm sewers.

Methods used in building tunnel of storm sewer at Houston, Tex. are outlined; shallow 447-ft-long section by open-cut method at one end of job was first installed and then 6500 ft was excavated with wheel-type mining machine; tunnel passes 35 to 40 ft. under many streets, railroad tracks, and about 100 utility lines; mining wheel had to go through 15-ft-wide gaps to be bordered by freeway columns later; to control wet ground, workers relied on deep wells, air pressure, and chemical grout.
W69-01756

HIGHWAY BRIDGE MEN BUILD TUNNEL-FOR WATER.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01758

STANDARDS FOR STORM-WATER FACILITIES.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01761

PROCEEDINGS OF THE THIRTEENTH CONFERENCE OF LOCAL AUTHORITY ENGINEERS, QUEENSLAND, 1962.

Queensland Dept of Local Government, Brisbane. 190 pp.

Descriptors: *Design, *Construction, *Drainage systems, *Storm runoff, Sewers.
Identifiers: *Storm sewers.

This publication contains the full text of papers and discussions presented at conference in Brisbane, October 1962, dealing with various subjects of concern to local authority engineers, including the design, construction, and maintenance of mild-steel reservoirs; service pipes for water-distribution systems; design, construction, and maintenance of open drains (both lined and unlined), including irrigation channels; materials for sewers and methods of jointing; dewatering of wet ground, including methods for lowering the water table; and the design and construction of storm-water drainage systems.
W69-01764

A GUIDE FOR ENGINEERS TO THE DESIGN OF STORM SEWER SYSTEMS, PREFACED BY THE REPORT OF THE JOINT COMMITTEE ON RAINFALL AND RUN-OFF OF THE ROAD

RESEARCH BOARD AND THE MINISTRY OF HOUSING AND LOCAL GOVERNMENT.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01766

SMALL UNDERGROUND DRAINS AND SEWERS: I AND II.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01767

STORM DRAINAGE SYSTEMS.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01769

STORM SEWER TUNNEL IN ST. PAUL,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01773

TORONTO CONFRONTS OUTDATED SEWERS,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01774

RETENTION BASIN ELIMINATES NEED FOR COSTLY STORM SEWERS,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01777

STORM WATER DETENTION IN URBAN AREAS,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01778

DESIGN OF SURFACE-WATER SEWERS,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01781

CALCULATION OF STORM-SEWAGE TANKS,

H. Fischer.
Gas Wasserfach, Vol 105, pp 543-544, 1964.

Descriptors: *Storm runoff, Design, Overflow, Discharge (Water).
Identifiers: *Storage tanks, *Calculations, *Capacity.

In connexion with the design of storm-sewage tanks for the Rheingonheim area of Ludwigshafen, investigations were carried out on the frequency of action of storm-sewage overflows, and the characteristics which should be considered when calculating the discharge after the peak load. Results showed that the characteristics of the flow record can be very variable for different periods of rain even if the maximum coefficient remains the same. The author presents graphs and a chart for a simplified calculation of discharge from storm-sewage overflows and gives a numerical example which can be adapted to any particular characteristic of discharge.
W69-01783

MAIN DRAINAGE OF LEYTON,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01786

CONSIDERATION OF STORAGE CAPACITY IN STORM-WATER SEWERS,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01788

PROBLEMS IN THE PLANNING OF SEWAGE WORKS.

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01824

CONTRIBUTION TO THE DETERMINATION OF THE DIMENSIONS OF RAIN STORAGE TANKS.

For primary bibliographic entry see Field 02E.
For abstract, see .
W69-01921

DESIGN AND OPERATION OF LOW-HEAD SELF-PRIMING SIPHONS.

C. D. C. Braine.
Surv., Vol 116, pp 1141-43, Nov 2, 1957.

Descriptors: Design, *Siphons, *Weirs, *Storm runoff, *Overflow, Sewers, Discharge (Water).

Small self-priming siphons have advantages over weirs for storm water overflows and other water level regulating uses in sewers and canals. They are as a rule cheaper than weirs provided that at least one foot of head is available. The siphon is more flexible in operation than a weir. Siphons can be made very sensitive, and by admitting air in limited quantities, their discharge can be varied considerably. Also installations of a battery of several siphons permits flexibility of discharge. Nine illustrations of siphon designs are given. Self-priming of a siphon is achieved by allowing a sheet of water to flow over the whole width of the crest so that as the sheet falls it strikes the opposite wall of the siphon. The falling sheet of water entrains air with it and carries it down to the outlet so that the siphon very quickly primes. A formula for estimating the discharge of circular siphons flowing full is given.
W69-01964

CULLEY V PEARL RIVER INDUS COMM'N (CONSTITUTIONALITY OF CONSTRUCTION OF LARGE DAM AND RESERVOIR).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01991

8B. Hydraulics**EVALUATION OF THE EFFECT OF MINING THE IRON ORE DEPOSITS OF THE KURSK MAGNETIC ANOMALY ON THE FLOW REGIME OF THE OSKOLETS RIVER.**

For primary bibliographic entry see Field 04C.
For abstract, see .
W69-01629

SEEPAGE THROUGH AN EARTH DAM COMPUTED BY THE RELAXATION TECHNIQUE.

Stanford Univ., Stanford, California.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-01641

FLUID FLOW MEASUREMENT.

Brit Patent 862,891.

Descriptors: *Flow measurement, *Pipes, *Tracers, Velocity.

A method is claimed for determining rates of fluid flow and comparing relative rates of flow under different conditions in pipes, canals, or rivers, by introducing a known quantity of radioactive material and monitoring the stream to obtain a time-integral value of the effect of the radioactivity during its passage or transit past a given point (by integrating the response of a radioactivity detector such as a Geiger counter). The method is based on the discovery that the integral or total number of gamma or other suitable radioactive rays detected is inversely proportional to the velocity of flow, but

is independent of the way in which the radioactivity is spread out along a segment of the fluid stream as the result of flow conditions.
W69-01658

PROGRESS REPORT OF THE STORM DRAINAGE RESEARCH PROJECT.

Johns Hopkins Univ., Baltimore, Md. Dept. Sanit. Eng. and Water Resources.

Report No 10: July 1, 1961 to June 30, 1962 Baltimore, June 1962, 187 pp.

Descriptors: *Instrument, *Storm runoff, Rain gages, *Flow measurement, *Weirs.
Identifiers: *Storm sewers, Surface permeability.

The results of the project's effort to develop reliable rainfall and stormwater runoff measuring instruments are presented. A depth type pressure sensing device for measuring the flow at a single point in a storm sewer, and a sharp-crested sensing weir for measuring the runoff entering a stormwater inlet, have been developed. It is felt that these instruments can be employed by other agencies with very few changes. The observation of widely differing amounts of runoff from storms of the same frequency, with changes in soil permeability as a factor, is one of the other problem areas mentioned.
W69-01659

THEORETICAL CONSIDERATION OF SIDE WEIRS AS STORM WATER OVERFLOWS.

P. Ackers.
Instn Civ Engrs Proc, London, Vol 6, pp 250-69, Discussion pp 328-43, Feb 1957.

Descriptors: *Overflow, *Weirs, *Storm runoff, Spillways, Discharge (Water), *Velocity.

Combining Bernoullis theorem and weir discharge formula, equation for water profile at side spillway can be derived, making allowance for variation in channel velocity; weir coefficient, velocity variation and extent of draw down are considered in relation to G.S. Coleman and D. Smith's results and simplified design formulae are given; insertion of dip plates may reduce discharge if clearances are small.
W69-01677

THE HYDRAULIC RESISTANCE OF DRAINAGE CONDUITS.

P. Ackers.
Proc Instn Civ Engrs, Vol 19, 1961.

Descriptors: Sewers, *Flow resistance, *Roughness (Hydraulic), *Velocity, *Storm drains, Pipes.
Identifiers: *Storm sewers.

Further details are given of theoretical and experimental studies on the hydraulic resistance of sewers and storm drains, which have been carried out by the Hydraulics Research Station (see Wat. Pollut. Abstr., 1963, 36, Abstr. No. 1823) including experiments on salt-glazed, spun concrete and pitch-fibre pipes, both full and partly-full. The results, given in tables and graphs, show that flow conditions in new sewers are turbulent-transitional and that the eccentricity and spacing of the joints affect the overall roughness. Neither the Crimp and Bruges nor the Manning formulae fit the experimental data and the equation proposed by Colebrook, C.F., and White, C.M., is preferred. On the basis of data obtained, roughness values for new sewers are suggested. Under partly-full conditions, proportional velocities follow the theoretical trend, but are lower, indicating an increase in roughness for free-surface flow, the possible cause of which is discussed.
W69-01698

TABLES FOR THE HYDRAULIC DESIGN OF STORM-DRAINS, SEWERS, AND PIPE-LINES.

P. Ackers.

Hydraul Res Pap No 4, H M Stationery Office, London, 1963.

Descriptors: *Hydraulic design, *Storm drains, *Sewers, *Velocity, *Roughness (Hydraulic), *Discharge (Water), Design, Pipes.
Identifiers: *Storm sewers.

To assist in the design of sewers and storm-water drains, this publication contains tabulated data on the discharges and velocities in pipes over a range of diameters (6-96 in.) hydraulic gradients (1 in 10,000 - 1 in 10), and roughnesses (k_s sub s values from 0.0002-0.05 ft.).
W69-01699

RAIN DISCHARGE AND SEWAGE SLUDGE.

G. Amberger.
Gesundheit-Ing, Vol 56, p 298, 1933.

Descriptors: *Storm runoff, *Sewers, *Design, Overflow.

When the sewage flow is so divided that half continues in the same direction, half through a pipe at an angle, then about 97% of the sludge goes through the latter pipe when the angle with the original direction is 30 degrees, about 87% when it is 120 degrees. These data are significant in the construction of plant by-passes to provide for heavy flow resulting from rains so that the richer sewage goes through the plant, the dil. being bypassed to the river.
W69-01700

HYDRAULIC BEHAVIOR OF STORM WATER INLETS.

W. H. Li, J. C. Geyer, and G. S. Benton.
Sewage and Industrial Wastes, Vol 23, pp 34-6, 1951.

Descriptors: *Model studies, *Intakes, *Storm runoff, Hydraulics.
Identifiers: Capacity.

Formulae based on studies of model inlets are developed for calculating the capacities of various types of gutter inlet without depression. There was close agreement between the calculated and observed values.
W69-01704

FLOW CHARACTERISTICS OF PVC SEWER PIPE.

L. C. Neale, and R. E. Price.
ASCE Proc, J Sanit Eng Div, Vol 90, No SA3, Pt 1, paper 3955, pp 109-29, June 1964.

Descriptors: *Plastic pipes, *Sewers, *Sewer hydraulics, Velocity, Head loss, *Flow measurement.

Flow tests were run of 8 and 12-in. thin-wall, flexible PVC pipe designed for use as sewers; pressure and open channel flow characteristics were investigated and analyzed; velocity profiles were made; it is shown that temperature has significant effect that should be considered in critical or marginal designs; head losses for solvent cemented bell and spigot joint were measured, and coefficients of 0.0011 with bell pointed downstream and 0.0068 with bell pointed upstream were determined.
W69-01705

FLOW VELOCITIES IN SMALL SEWERS.

R. D. Pomeroy.
J Water Poll Control Fed, Vol 39, pp 1525-1548, 1967.

Descriptors: *Velocity, *Sewers, *Sewer hydraulics.
Identifiers: *Calculations.

Methods were developed for obtaining data on velocity and discharge in sewers for use in calculat-

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ing the coefficients in hydraulic equation, and these techniques were used on 95 small sewers. The data obtained, together with published studies on experimental pipes, confirm the conditions of previous investigators that velocities in partly-filled pipes do not conform to the traditional equations. From the data obtained, equations were developed for velocities in partly-filled pipes of circular section. The experimental results also confirmed the accepted view that a velocity of 0.5–0.6 m per sec, or 1.6–2 ft per sec, is required to avoid excessive accumulations of debris. There was evidence of a retarding effect of critical-depth turbulence, but it is impracticable to avoid these effects in the smallest sewers. It was found that poor construction, including irregularities of slope, is often the cause of poor coefficients; the asbestos-cement sewers tested showed better coefficients than the vitrified-clay sewers, and the concrete sewers were poorest.

W69-01706

FLOW VELOCITY IN PARTLY FILLED PIPES,

Richard Pomeroy.

Water and Sewage Works, Vol 108, p 180, May 1961.

Descriptors: *Velocity, Flow measurement, *Pipes. Identifiers: *Calculations.

It is important, for a variety of purposes in the sanitary engineering field, to be able to calculate velocity and flow conditions in sewers running less than full. The equation which has come to be known as Manning's is most commonly used for this purpose. This equation rests upon the classical assumption that velocity can be calculated as a function of R, S, and a friction coefficient. This basic assumption is an approximation when streams of different shape of cross section are considered. This following equation has been deduced for calculating velocity of flow in a partly filled pipe of circular cross section. $V = k(Q \exp(0.29)(S \exp(0.38))^{0.13})$. This equation conforms to available data better than the Manning equation. The value of k is related to the Hazen-Williams coefficient by the equation $k = 0.702 m C (0.71)$ in which m is approximately 1.10.

W69-01707

MEASUREMENT OF MANNING'S ROUGHNESS COEFFICIENT,

O. J. Schmidt.

Sewage Industr Wastes, Vol 31, p 995, 1959.

Descriptors: *Sewers, *Velocity, *Design, Construction, *Roughness (Hydraulic). Identifiers: *Combined sewers, *Kansas City (Mo.), Urban drainage.

In connection with a master plan for trunk sewers and sewage-treatment facilities in Kansas City, Mo., a series of velocity measurements was made in a large trunk sewer carrying both sewage and storm water. The method used to measure mean velocity is described; it is considered to be as simple, accurate, and inexpensive as more conventional procedures. Variations in n in Manning's formula occur with changes in depth of flow in sewers and for certain sewer designs such variations can be important. The value of n can be changed from that used in the design of the sewer by a number of conditions brought about during construction or which can occur afterwards. Bottom deposits or other conditions which greatly alter the invert surfaces of the sewer probably caused a greater variation in n than that caused by changes in depth of flow. Some aspects on which further investigations are required, are indicated.

W69-01709

OPTIMUM DESIGN OF SEWERS,

A. A. Smith.

Civ Eng Publ Works Rev, Vol 60, p 206, 1965.

Descriptors: *Sewers, *Design. Identifiers: Capacity, Calculations.

After a brief review of the general properties of partly full circular conduits as applied to sewer design, the author shows that the effect of shape is both significant and important in the design of sewers of adequate carrying capacity. The concept of optimal sewer diameter is developed, and the relevance of criteria of self-scouring and carrying capacity is considered. A design chart is given for the solution of problems of a general nature, with some practical examples of its use.

W69-01710

SOME HYDRAULIC ASPECTS OF SEWERAGE AND SEWAGE DISPOSAL,

C. B. Townend, and G. W. Wilkinson.

Instn Civ Engrs, Proc, Vol 4, Pt 3, No 3, pp 662-84, Dec 1955.

Descriptors: *Sewage treatment, *Hydraulics, *Storm runoff, Discharge (Water), *Velocity, *Sedimentation, *Flow control. Identifiers: *Suspended solids.

Sequence of operations in sewers and at treatment plants; application of hydraulic principles to assure efficient transport and removal of solids; storm-water runoff, discharge formulas relating to sewers, channels and pipes; effects of sewage handling on hydraulic practice, control of velocities and levels, distribution of flow, and sedimentation procedures.

W69-01711

DRAINAGE (SEWERAGE).

J Inst of Sanit Engrs, Vol 50, pp 177-94, 1951.

Descriptors: *Storm runoff, *Overflow, Velocity, Sewers, Flow, *Runoff, Design. Identifiers: *Lloyd-Davies formula.

In a discussion on the C.E. Code of Practice No. 5 (1950) 'Drainage (Sewerage)', subjects raised included velocity of flow in sewers, admission of trade waste waters to sewers, storm water overflows, and the Lloyd-Davies method of calculating run-off.

W69-01718

PRINCIPLES FOR CALCULATING FLOWS IN SEPARATE AND COMBINED SEWERS,

Waclaw Blaszczyk.

Gaz Woda Tech Sanit, Vol 26, No 1, p 24, 1952.

Descriptors: *Rainfall intensity, *Design, *Sewers, *Flow measurement. Identifiers: *Combined sewers, Warsaw (Poland).

Following a review of the theory of calculating combined sewer flows by means of several expressions, the author presents time-intensity plots proposed by various authorities for Warsaw, in which intensities for a rainfall of 1/2 min. vary from 25 to 202 l. per second per hectare; for t = 1 min., i varies from 16 to 124; for t = 2 min., i varies from 12 to 70; and for t = 3 min., i varies from 9 to 58. In many projects, the results are based upon the experience of the designer as indicated by the data cited above. Accordingly, the author proposes that it is necessary to come to some agreement as to the coefficient of probability to be used for economical sewer design, and that it should not be necessary to depend wholly upon the judgment of the designer. Of course, the establishment of suitable norms must be based upon thorough and complete calculations and review of existing data. No one, according to the author, has dependable results, as practically none of the designers have had the opportunity of confirming their calculations in practice, because in many cases the system has not been completed as designed, the drainage area has not been fully settled, or the rains designed for have not occurred.

W69-01727

INFILTRATION INTO SEWERS.

N Z Eng, Vol 14, pp 233-238, 1959.

Descriptors: *Storm runoff, Sewers.

Identifiers: *Sewer infiltration.

In 1957 the Council of the New Zealand Institution of Engineers set up a committee to investigate into the excessive infiltration and entry of storm water into sanitary sewers. In the first report of the committee, the results of a questionnaire sent to various authorities are summarized, and conclusions drawn therefrom are studied. It appears that storm-water entry and/or infiltration is serious in 75 per cent of the systems studied. It is recommended that further investigation should be made into causes of infiltration and possible remedies, including the preparation of a code of good practice in the laying of sewers and drains.

W69-01732

EXFILTRATION TESTING OF LARGE SEWERS.

Public Works, p 108, Jan 1968.

Descriptors: *Sewers, Construction.

Identifiers: *Sewer infiltration, *Sewer exfiltration.

Infiltration and exfiltration methods for ground water leakage into sewers are compared. Tests were performed on sewer pipes ranging from 27 to 72 in. Test results showed that exfiltration testing is a valuable tool in sewer construction.

W69-01733

ESTIMATING THE CAPACITY OF SEWERS AND STORM DRAINS.

For primary bibliographic entry see Field 04A.

For abstract, see .

W69-01751

EFFECTS OF USE ON THE HYDRAULIC RESISTANCE OF DRAINAGE CONDUITS,

P. Ackers, M. J. Crickmore, and D. W. Holmes.

Proc Instn civ Engrs, Vol 28, Pap No 6743, pp 339-359, 1964.

Descriptors: *Pipes, Drainage systems, Conduits, Roughness (Hydraulic), *Aging (Physical), Deterioration. Identifiers: *Capacity.

As a sequel to studies on the hydraulic roughness of new sewer pipes (see Wat. Pollut. Abstr., 1963, 36, Abstr. No. 2021), field experiments were carried out to obtain information on the probable deterioration of capacity with age and use. The studies, in which both salt-velocity and radioactive-tracer techniques were used (the iodine-132 method being found most convenient for use in sewers), were carried out at 20 sites giving a wide range of pipe materials, sizes, gradients, and degrees of slimming; and roughness values were calculated using the Colebrook-White equation for turbulent flow. Slime became established in sewers after a relatively short period of use and tended to predominate near the normal water level, but the degree of slimming varied considerably at the different sites, probably depending on the composition of the sewage as well as the boundary shear. Layers of slime less than 1/8-inch thick had little effect on the resistance to flow or the capacity of the pipe, but above this level the resistance to flow increased rapidly with thickness of slime. Compared with slime, the presence of sediment in the invert had more marked effects on the roughness values particularly under conditions such that standing waves were produced. The effects of sediment varied widely depending on the 'bed form' (a function of particle size) and the flow conditions. Based on the experimental results, roughness values are recommended for mature foul sewers.

W69-01752

8C. Hydraulic Machinery

AUTOMATIC CONTROL VALVES,

R. H. Babcock.

Water Wastes Eng, Vol 5, No 1, pp 43-5, Jan 1968.

Descriptors: *Automatic control, *Flow control, *Instrumentation, Sewage treatment, Hydraulics. Identifiers: *Calculations.

Many specialized valves are now incorporated in the automatic control of sanitary systems and successful application of a control valve to a process requires complete understanding of the hydraulics of the system under design. Design techniques for control problems involve flow of reagents (pH control), pipeline losses, inlet losses, outlet losses, and fitting losses. In every case a valve can be considered a control of simple flow between two reservoirs. A valve may also be considered a variable orifice. Derivations of sizing equations for (1) liquids, (2) gases and (3) steam and other vapors are given. A table presents typical valve coefficients for valve types such as butterfly, needle, and wide range V port. Some typical valve sizing problems are presented and solved by application of the equations derived.

W69-01660

BUILT TO BE SEEN,
Wilsey and Ham, San Mateo, Calif.
Daniel W. Klar.
Amer City, pp 96-97, May 1967.

Descriptors: *Pumping, *Storm runoff.

A pump station in Foster City, Calif. is described. The station serves a community with an expected population of 35,000 in 1977, and with an average elevation of 4.5 ft. above sea level. The station has a system of levees, collecting lagoons and waterways for storm drainage. The pumps circulate 400,000,000 gals. of water each week to keep lagoons and waterways clean and clear. Pumping equipment and station layout are described.

W69-01675

FLUSHING OF SEWER NETWORKS: AUTOMATIC DISCHARGE DEVICE,
A. Lencastre.
Mem Minist Obr Publ, Lisbon, No 109, 1957.

Descriptors: *Automatic control, Instrumentation. Identifiers: *Sewer flushing.

Investigations were carried out on 3 automatic discharge systems for use in flushing sewers, to determine the effectiveness of automatic operation even at very small rates of flow.

W69-01676

AUTOMATIC CONTROL OF PUMPING INSTALLATIONS,
I. M. E. Aitken, and R. A. F. Craven.
Effluent and Water Treatment Convention, London, 1965. 10 pp.

Descriptors: *Pumping, Automatic control, *Overflow.

In discussing the application of automatic control devices in sewage pumping stations, the authors describe and give a schematic diagram of a single-range control system in which two electrode probes in the inflow-reception sump are used in conjunction with a simple programme controller to control the operation of a number of single-speed pumps of different ratings which can be brought into service in different combinations. The same system can also be used to adjust the rate of pumping in relation to the amount of storm-water overflow and to control the rate of pumping in the recirculation of effluent at sewage works. The basic principles of the system are also applicable when other level-sensing devices are used instead of the electrode probes in the reception sump.

W69-01680

PVC SEA OUTFALL IN HUNSTANTON SEWAGE SCHEME.
Surv Munic Cty Engr, Vol 128, No 3876, pp 22-24, 1966.

Descriptors: Outlets, Storm runoff, *Overflow, *Pumping, Automatic control, Plastic pipes.

An illustrated description, with a plan of the outfall pumping station, is given of the installation at Hunstanton, Norfolk, of a 10-in diameter polyvinylchloride submarine outfall 0.5 mile long, consisting of 20-ft lengths of pipe with acetone cement joints. Subsidiary pumps convey crude sewage to the outfall pumping station; at low tide and normal rates of flow the outfall conveys the sewage under gravity, but at high tide or for high rates of flow the pipeline becomes surcharged and the outfall pumps operate automatically when an overflow sump fills. Provision is made at the pumping station for continuation, the disintegrator being controlled automatically by a lunar clock to operate when the tide is ebbing. Flows in excess of 4.5 times the dry-weather flow are discharged through a separate storm-sewage outfall, a cast-iron pipe extending to the mid-tide mark.

W69-01687

NEW SEWAGE WORKS COMMISSIONED AT LEICESTER.

Surv Munic Engr, Vol 124, No 3773, pp 25-27, Sept. 26, 1964.

Descriptors: *Overflow, *Storm runoff, Weirs, Pumping.

Identifiers: Storage tanks.

These works are designed for a dwf of over 20 million gal and are capable of extension to treat 22 1/2 million gal. On reception, sewage passes through screens and detritors, screenings being returned to flow through disintegrators; washers clean the grit, which is then pumped to a tip at the edge of the works. A weir overflows storm water in excess of 85 million gal/d direct to the River Soar; the residual flow is lifted 12 ft by 6 centrifugal pumps to permit gravitation through the works. Two of these pumps, each of which has a capacity of 7,500 gal/min, are driven by variable-speed motors controlled by electrodes in the pump well, which allows for changes in flow. Two 24-in. diesel-driven pumps are used for pumping to the storm water tanks.

W69-01688

OPERATING EXPERIENCES AT SWINDON, 1962 - 1967.

For primary bibliographic entry see Field 05D. For abstract, see .

W69-01696

FLOOD RELIEF SCHEME FOR WEST LONDON.

For primary bibliographic entry see Field 04A. For abstract, see .

W69-01763

8D. Soil Mechanics

FLOOD SURGE ON THE RUBICON RIVER, CALIFORNIA--HYDROLOGY, HYDRAULICS AND BOULDER TRANSPORT,
U.S. Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .

W69-01610

LABORATORY INVESTIGATION OF SOIL INFILTRATION THROUGH PIPE JOINTS,
For primary bibliographic entry see Field 05B.
For abstract, see .

W69-01749

8G. Materials

POLYMER COAGULATORS.

For primary bibliographic entry see Field 04A. For abstract, see .

W69-01701

SEWER INFILTRATION.

Water Wastes Eng, Vol 4, No 10, p 22, Oct 1967.

Descriptors: *Sewers, Pipes, Sealants, Pumping, *Biochemical oxygen demand.

Identifiers: *Sewer infiltration, *Residential sewers, *Suspended solids.

Engineers of sewage treatment facilities in six areas of the U.S. were surveyed concerning sewer infiltration: frequency of determination of the extent of infiltration, percentage of sewer flow resulting from infiltration, steps to reduce infiltration, and effect of infiltration on the treatment plant operation. Infiltration was reported to be a problem in each area. Steps used to curb infiltration were: prompt repair of broken or damaged sewers, replacement of sewer pipe with pipes of materials better suited for the area, and enforcement of ordinances prohibiting footing drains and downspouts. High cost prevented the use of sewer linings and chemically-sealed joints. Root infestation was also a problem in each area surveyed. It is the most difficult source of infiltration to locate and correct and may account for as much as 50% of total infiltration. Infiltration affected treatment plant operation by increasing the cost of pumping and reducing BOD and suspended solids. Percentage of the total flow in the sewers resulting from infiltration was estimated to vary between 10 and 50%.

W69-01735

DETECTION AND SEALING OF LEAKS IN SEWERS.

For primary bibliographic entry see Field 05B. For abstract, see .

W69-01738

PIPE JOINTS LIMIT INFILTRATION.

G. W. Clark, Jr., and M. L. Leyrer.
Civ Eng, Vol 37, No 1, pp 62-3, Jan 1967.

Descriptors: Sewers, Construction, *Manholes. Identifiers: *Sewer infiltration.

City engineers in Muskegon, Mich. designed sanitary sewer trunk that would be placed in area having high water table; limiting infiltration was most important; this was accomplished through use of rubber O-ring joint gaskets, and good construction and inspection procedures; tests on completed line show infiltration to between 14.5 and 55.7% of maximum allowable rate of 200 gal/in. of internal diameter per mile of pipe per day; much of this infiltration took place at precast manhole joints, which did not have rubber O-ring joint specified.

W69-01739

EXFILTRATION TESTING OF LARGE SEWERS IN KANSAS CITY, MO.

For primary bibliographic entry see Field 05B. For abstract, see .

W69-01741

ELIMINATING INFILTRATION OF GROUND WATER INTO SEWERS.

For primary bibliographic entry see Field 05B. For abstract, see .

W69-01743

INFILTRATION AND SEWER FOUNDATIONS.

F. W. MacDonald, J. K. Mayer, and S. E. Steimle.
Pub Works, Vol 98, No 12, pp 105-7, Dec 1967.

Descriptors: *Sewers, *Design.

Identifiers: *Sewer infiltration, Gulf Coast.

Study was initiated to determine most suitable foundation materials and best types of sewer arrangements, under various conditions, which will effectively decrease and control infiltration in Gulf Coast area, and to test various foundation materials and arrangements in combination with various lay-

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ing conditions in order to determine most suitable bedding in number of soil types common to area.
W69-01746

INFILTRATION AND SEWER FOUNDATIONS,
Tulane Univ., New Orleans, La.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-01747

SEAL SEWER LEAKS FROM INSIDE,
R. Nooe.
Am City, Vol 79, No 6, pp 91-2, June 1964.

Descriptors: *Sealants.
Identifiers: *Sewer infiltration.

Method recommended to repair sewers from inside using special internal injection techniques controlled and observed by TV camera; injected chemical gel stops infiltration and is reported to lower cost of sewer rehabilitation.
W69-01750

EPOXY SOLVES HAZARDOUS SEWER LINING PROBLEM,
F. V. Cornelius.

Pub Works, Vol 98, No 1, p 126, Jan 1967.

Descriptors: Sewers, *Sealants.
Identifiers: *Storm sewers, Polymers.

Utilization of epoxy materials for lining large storm sewer following explosion while heating asphalt mixture for lining; Commercial Chem Co, Cincinnati, Ohio, supplied Epo-Patch and Epo-Surfacer compounds to trowel in invert and spray top part of corrugated pipe; thickness of epoxy application ranged from 10 mils to 6 in.; approximately 82 gal were required for complete lining of sewer.
W69-01776

8I. Fisheries Engineering

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For primary bibliographic entry see Field 06E.
For abstract, see .
W69-01930

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For primary bibliographic entry see Field 06E.
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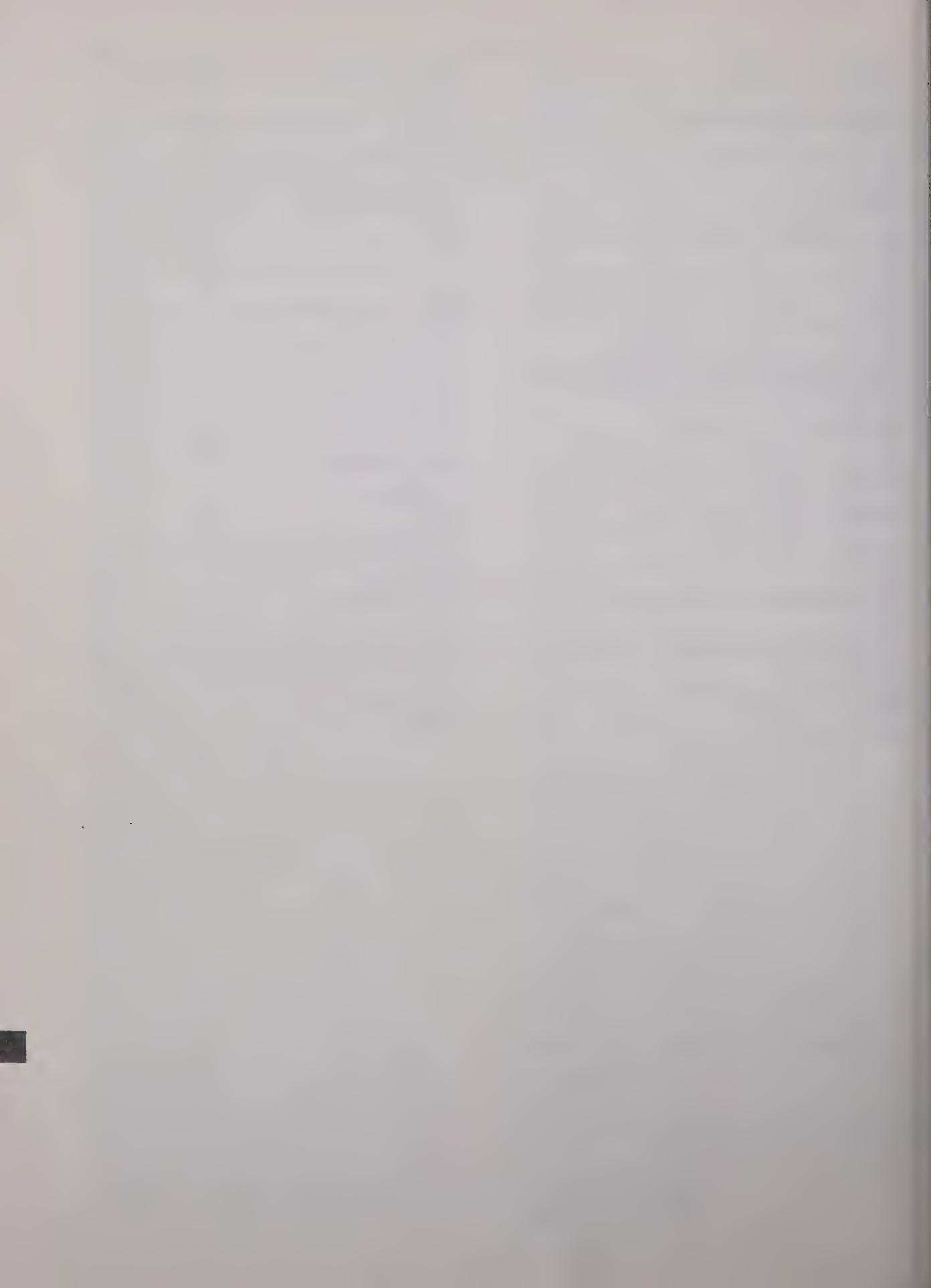
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